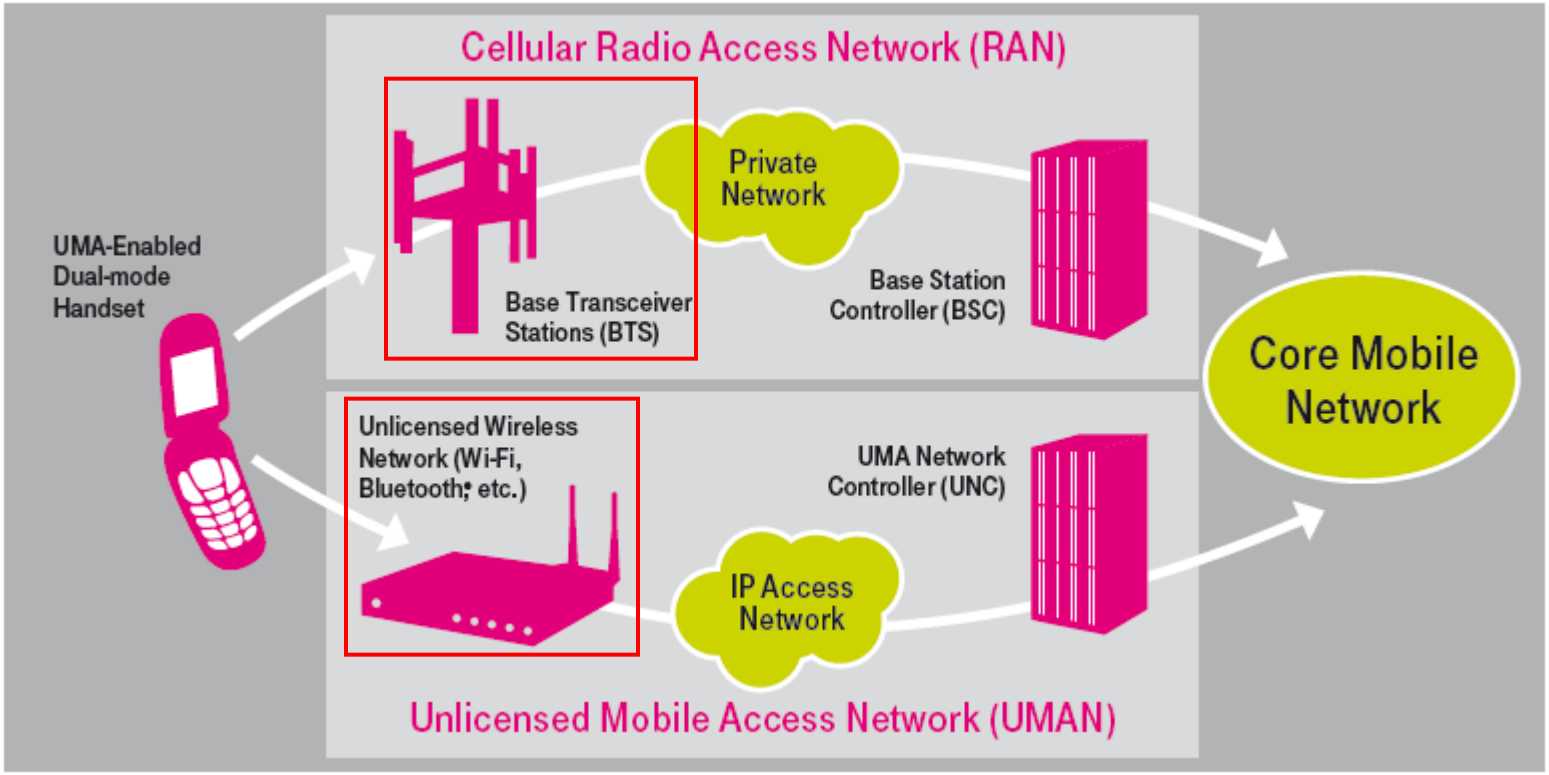
INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
1. A wireless network including:	Each combination having at least one item listed on Exhibit A, at least one item listed on Exhibit B, and at least one item listed on Exhibit C is a system (hereafter "Accused System"). Because infringement liability is not dependent on ownership, e.g., use of a system can infringe (35 U.S.C. § 271), infringement is not dependent on ownership of all limitations of a claim. A wireless network comprises at least: (1) Radio Access Network comprising at least one base station controller, at least one transceiver, and at least one antenna; (2) a system of computers, the system of computers comprising computers associated with the at least one base station controller(s); computers functioning for network optimization, including at least computers implementing D-SON and C-SON; and, computers functioning for locating wireless devices; and, (3) one or more wireless devices.[1] There is no requirement that each computer of the system of computers locates a UE.
at least one radio-frequency transceiver and an associated at least one antenna to which the at least one radio-frequency transceiver is coupled,	Plaintiff contends each item listed on Exhibit A corresponds to this claim limitation because each Exhibit-A item is a base station. Base stations include at least one radio-frequency transceiver designed and used in association with at least one antenna. When base-station transceivers and antennas are in communication, they are coupled. Further, in addition to being so coupled, the transceivers and antenna of each Exhibit-A item are also, by placement within a base station, physically coupled. The following exemplifies this limitation's existence in Accused Systems:

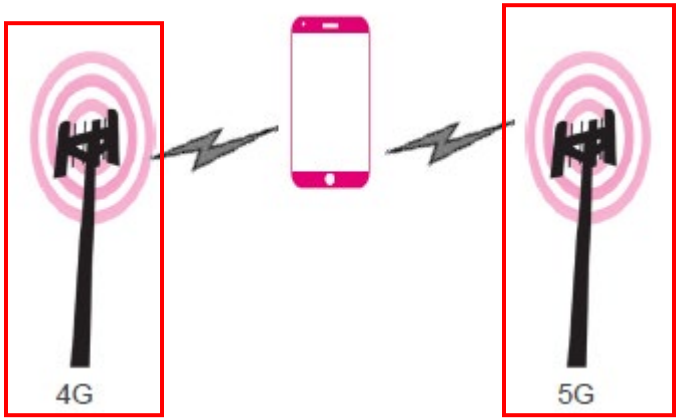
[1] A wireless device is considered within the wireless network when in RF communication. However, a processor of such wireless device may also be considered outside or inside the network.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

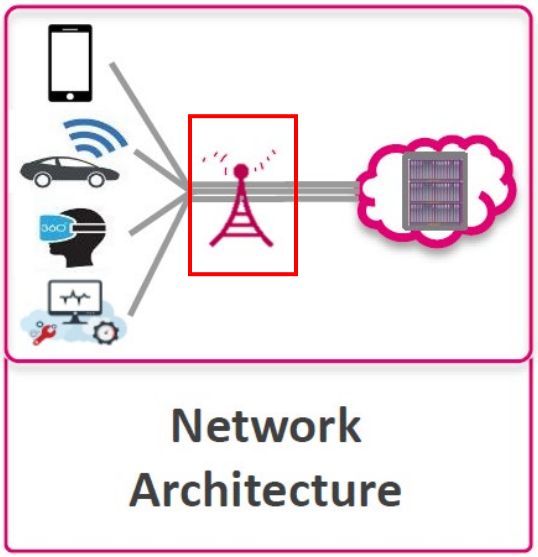
Claim 1	Corresponding Structure in Accused Systems
	 **Attachment 4 (T-Mobile Wi-Fi Calling for Government (2009)) at 1.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 5 (Journey to 5G –T-Mobile US Perspective) at 6.



***Id.* at 11.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

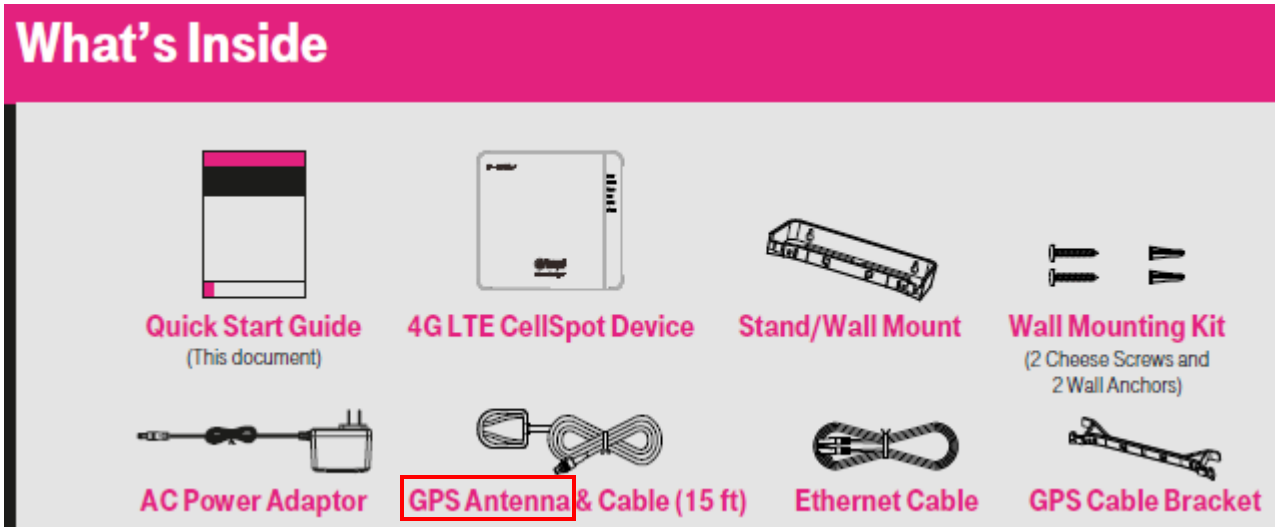
Claim 1	Corresponding Structure in Accused Systems
	6. Antenna Coax and BTS Grounding COAX: a. Coaxial cable grounding shall typically be placed at the top (near bend to antenna), in the middle on vertical runs over 200 feet, at the bottom of the tower (near bend to ice bridge), and at the Antenna ground buss (AGB) outside the BTS or building at a minimum. b. The ground kit leads to the buss bars are to be straight with excess trimmed off prior to attachment. c. All ground leads are to be attached with two hole lugs and no corrosive goop (Noalox). EQUIPMENT: a. Tenant shall install a ground ring around their own equipment and tie grounds to the existing ground system in a minimum of two (2) locations. b. Tenant shall not disturb existing grounding (except as noted above). Each antenna coaxial cable shall be grounded at three points using a coaxial cable kit from the manufacturer of the antenna cable (4 points if tower is over 200' and/or lamped). **Attachment 6 (T-Mobile Towers Co-Location Construction Standards (2009)) at 21.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

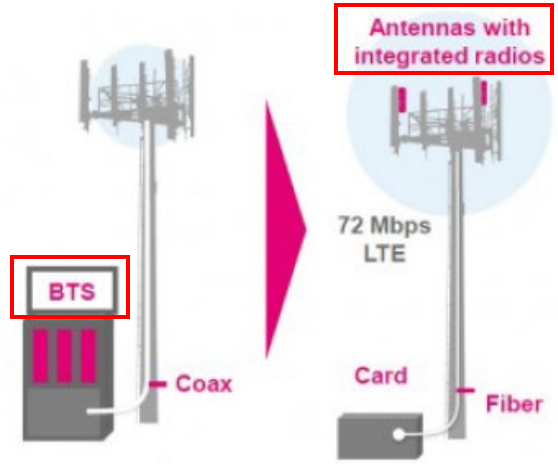
Claim 1	Corresponding Structure in Accused Systems
	  **Attachment 7 (4G LTE CellSpot® Quick Start Guide (2015)) at 1.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

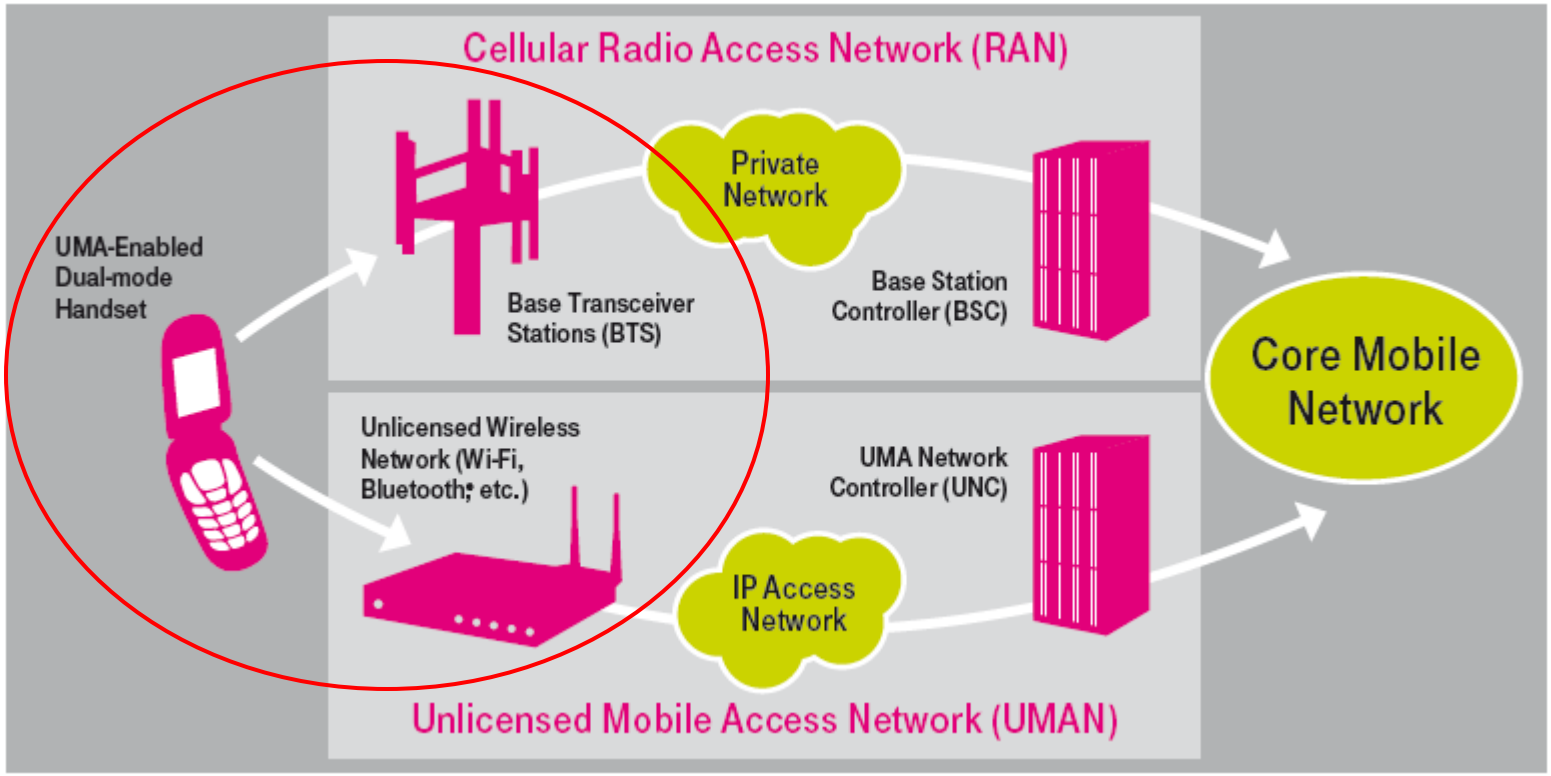


***Id.* at 2.**



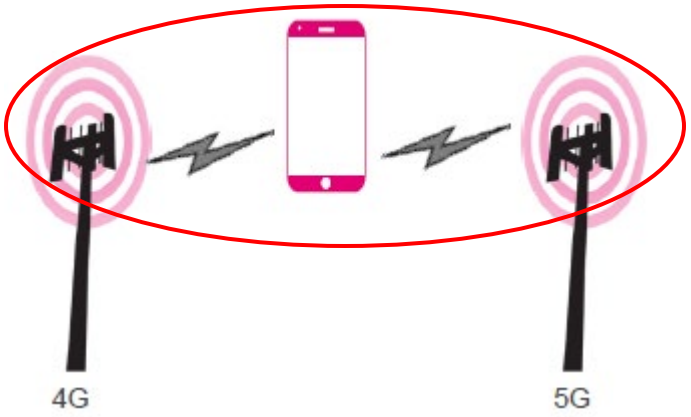
Attachment 3 (T-Mobile Announces LTE, Prepares To Take The US Wireless Market By Storm (Webpage, 2012)) at 2.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

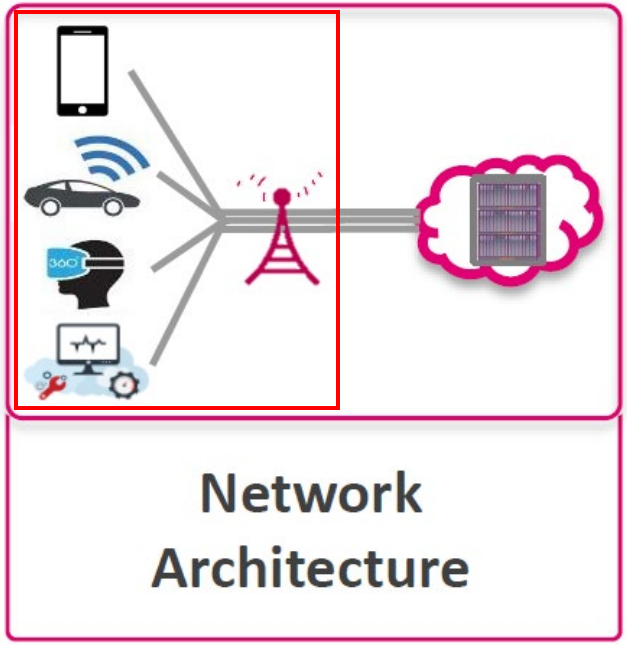
Claim 1	Corresponding Structure in Accused Systems
wherein the at least one radio-frequency transceiver is configured for radio-frequency communication with at least one mobile wireless communications device; and	Plaintiff contends each item listed on Exhibit A corresponds to this claim limitation because each Exhibit-A item is a base station having a RF transceiver whose parameters have been configured for RF communication with mobile wireless communications devices (specifically one or more of the mobile wireless communications devices identified on Exhibit B). The following exemplifies this limitation's existence in Accused Systems:  **Attachment 4 (T-Mobile Wi-Fi Calling for Government (2009)) at 1.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 5 (Journey to 5G –T-Mobile US Perspective) at 6.



***Id.* at 11.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

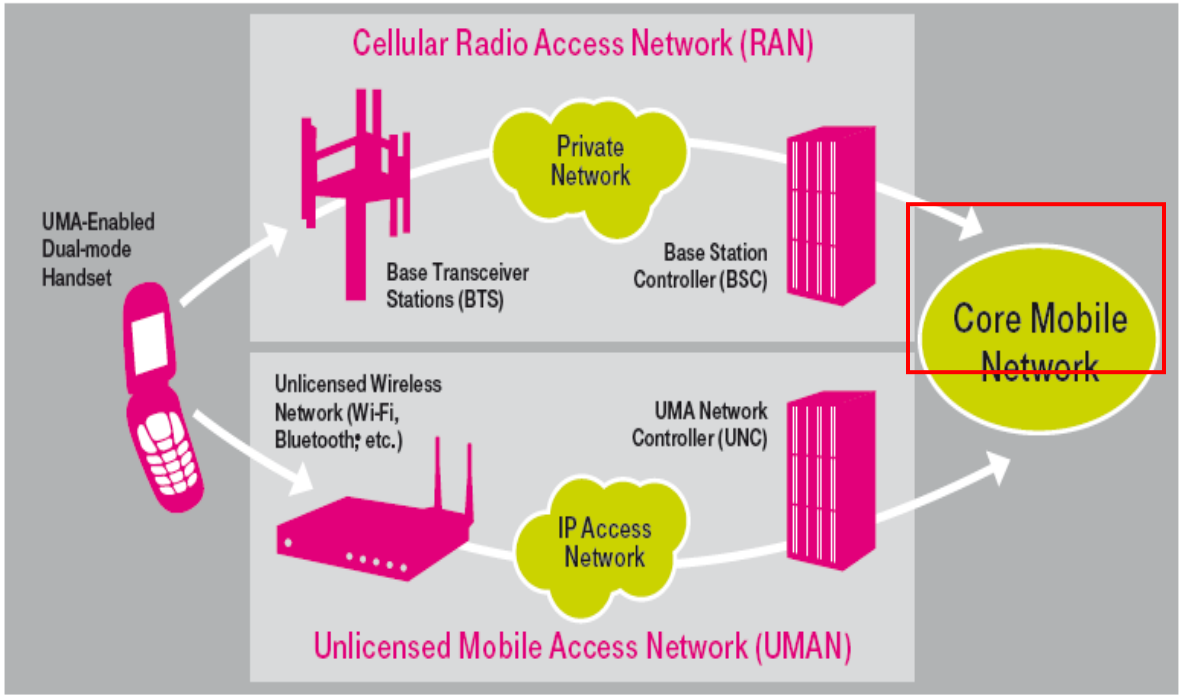
Claim 1	Corresponding Structure in Accused Systems
a system of computers coupled to the at least one radio-frequency transceiver programmed to locate the at least one mobile wireless communications device and acquire an indication of a location of the at least one mobile wireless communications device,	Plaintiff contends that a system of computers comprises wireless device location elements, including but not limited to one or more of position determination entities (PDE), mobile location/positioning centers, mobile switching center, location proxy servers, locations applications, location agents, GPS server, Wi-Fi server, home location register, visiting location register, one or more of which are used in locating a wireless device. The various location elements are T-Mobile components, T-Mobile subsidiaries or family of companies, vendors, partners and the like. The various location elements are meant to work across one or more of all technologies, including 2G, 3G, 4G, and 5G. Another portion of the system of computers may be executing or loaded with Nokia Eden-Net (or Nokia iSON or Nokia NetAct) is capable of locating and acquiring an indication of a location of at least one mobile wireless communications device. The system of computers is coupled to at least one RF transceiver (i.e., Base-Station, eNodeB, etc.). Nokia Eden-Net has software code specifically designed for use by one or more computers. Further, Nokia Eden-Net is designed to and does provide programming that allows the system when coupled to a base station (i.e., eNB with antenna) to locate a mobile wireless communications device(s) and generate or acquire an indication of location(s) of that device(s). The system loaded with Nokia Eden-Net collects UE location information as well as network performance measurements, stores the location information and performance measurements in a memory. Further, Plaintiff contends that "system of computers" also includes one or more computers {i.e., one or more computers, servers, computing devices, computing systems, etc. within or outside the T-Mobile's Network or T-Mobile's facility such as one or more computers, servers, computing devices, computing systems, etc. of third-parties, location based service (LBS) providers, T-Mobile's subsidiaries or family of companies, vendors, partners, Aggregators, etc. (e.g., LocationSmart, LOC-AID, LocationLabs, etc.)} is coupled in communication with the system of computers executing or loaded with Operations Support System (OSS or OSS-RC) of T-Mobile Wireless' wireless telecommunications network, Nokia Eden-Net (or Nokia iSON or Nokia NetAct). A wireless network comprises at least: (1) Radio Access Network comprising at least one base station controller, at least one transceiver, and at least one antenna; (2) a system of computers, the system of computers comprising computers associated with the at least one base station controller(s); computers functioning for network optimization, including at least computers implementing D-SON and C-SON; and, computers functioning for locating wireless devices; and, (3) one or more wireless devices.[2] Thus, the wireless communications network comprises a system of computers a portion of which is executing or loaded with

[2] A wireless device is considered within the wireless network when in RF communication. However, a processor of such wireless device may also be considered outside or inside the network.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

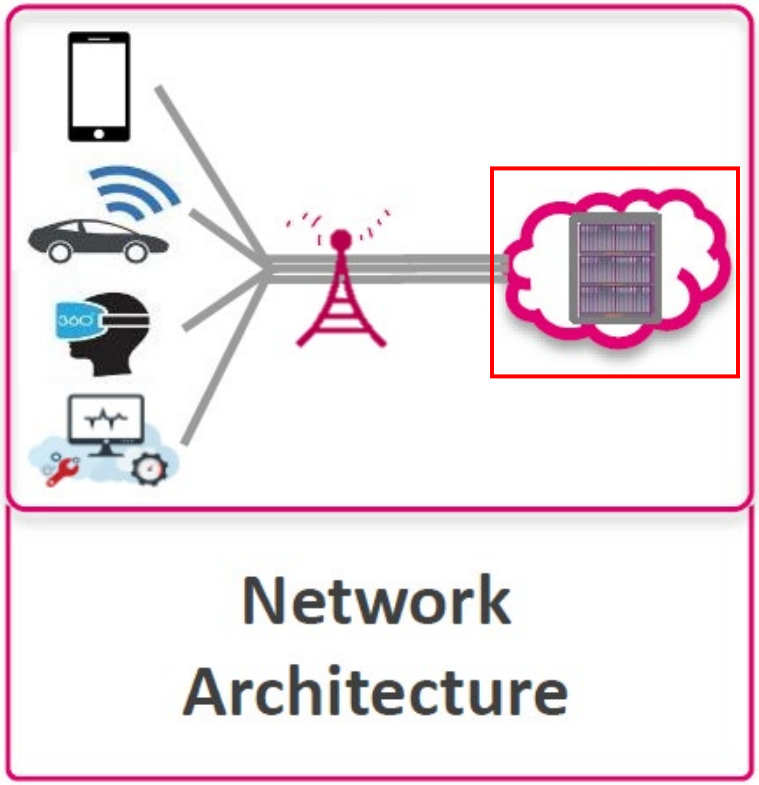
Claim 1	Corresponding Structure in Accused Systems
	Nokia Eden-Net is part of a package of software suites. The package of software can be implemented in macrocells, small cells, and femtocells to Universal Mobile Telecommunications Service (UMTS), Long-Term Evolution (LTE), Global System for Mobile Communications (GSM), and Wi-Fi technologies. Many of these network systems, particularly the cells include base stations for transmission and reception of wireless signals to and from the mobile wireless communication devices or UEs or user devices (mobile phones, laptops, tablets, PDAs etc.). These base stations are, therefore, RF transceivers. Also, these base stations are coupled with at least one antenna for the function of transmission and reception. Further, the system of computers comprises wireless device location elements, including but not limited to one or more of position determination entities (PDE), mobile location/positioning centers, mobile switching center, location proxy servers, locations applications, location agents, GPS server, Wi-Fi server, home location register, visiting location register, one or more of which are used in locating a wireless device. The various location elements are T-Mobile components, T-Mobile subsidiaries or family of companies, vendors, partners and the like. The various location elements are meant to work across one or more of all technologies, including 2G, 3G, 4G, and 5G. The following exemplifies this limitation's existence in Accused Systems:

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	 **Attachment 4 (T-Mobile Wi-Fi Calling for Government (2009)) at 1.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 5 (Journey to 5G –T-Mobile US Perspective) at 11.

Location Data

We may collect your device's location whenever it is turned on (subject to coverage limitations).

Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 5.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

T-Mobile to use Eden Rock's SON to reduce dropped calls, increase throughput

By **Tammy Parker** • Jun 22, 2014 08:49pm

T-Mobile US (NYSE:TMUS) intends to deploy Eden Rock Communications' self-organizing network (SON) technology nationwide to improve network services.

Founded in 2007, Eden Rock is based in Washington state, as is T-Mobile, Deutsche Telekom's U.S. wireless arm. The vendor's Eden-Net library of SON modules uses cloud-based software intelligence to enhance the performance of 2G, 3G and LTE networks. The SON product works with radio access networks (RANs) provided by multiple vendors to automate the configuration, optimization and maintenance of large-scale modern networks.

The vendor said that during T-Mobile's SON evaluation process, Eden-Net "simultaneously delivered fewer dropped calls, increased throughput, and reduced leakage--even as measured across entire markets, which had been previously well optimized."

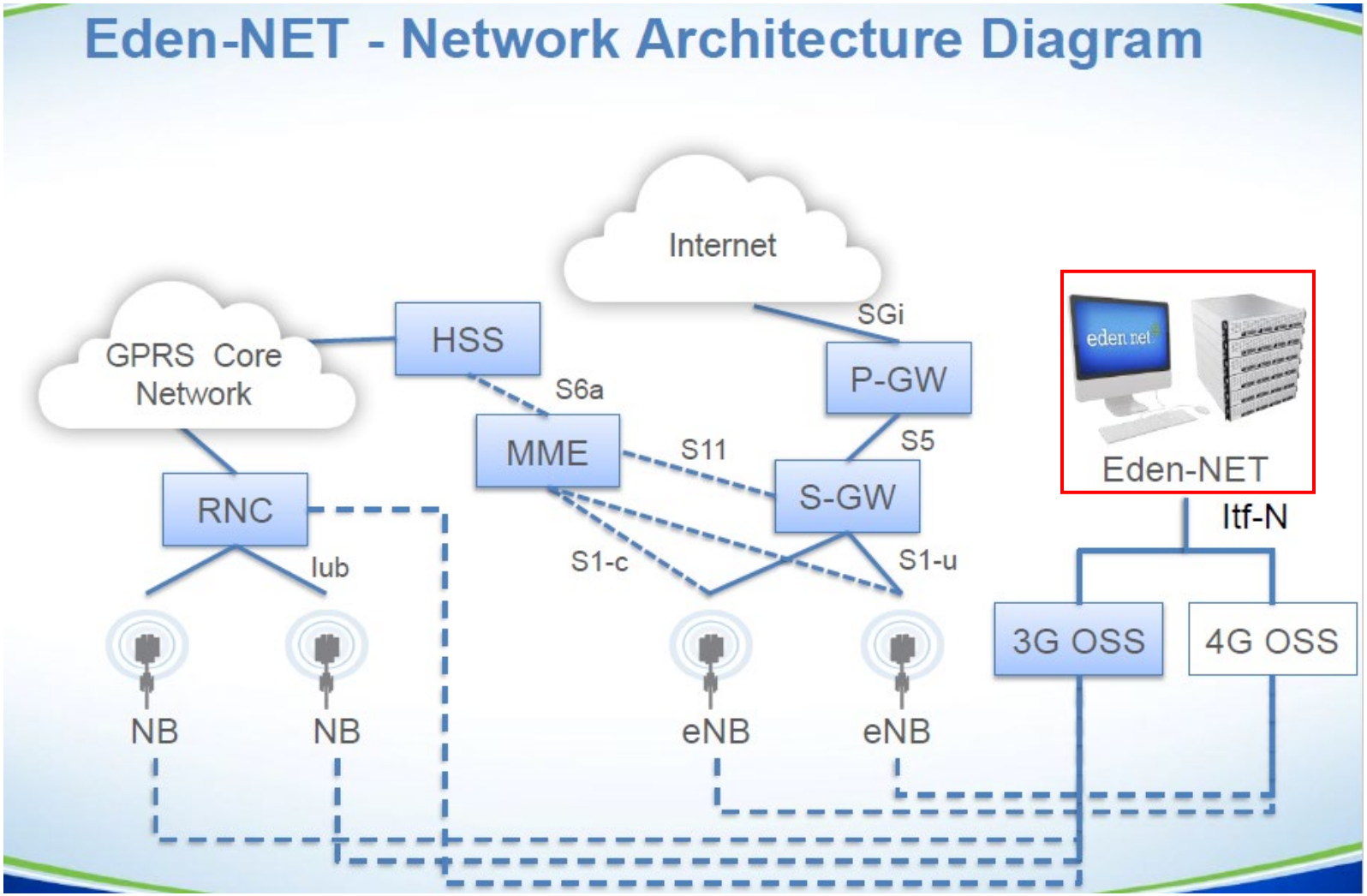
According to Grant Castle, vice president of engineering services and QA for T-Mobile, "with Eden Rock's SON solution we have seen improvements in our network. Furthermore, the operating system framework should enable us to roll out additional SON modules for even further network gains and operational improvements throughout 2014 and beyond."

SON is becoming a key tool for operators as they struggle to handle the growing complexity of their mobile networks. SON technology can be used in multiple ways, including network self-configuration using automatic neighbor relation (ANR) functionality, self-optimization, including traffic load balancing, and self-healing of network problems. ANR, included in 3GPP Release 8, has been described as the most widely deployed SON feature in 3G and 4G.

Attachment 17 (T-Mobile to use Eden Rock's SON to reduce dropped calls, increase throughput _ Fierce Wireless (Webpage, 2014)) at 1 & 2.

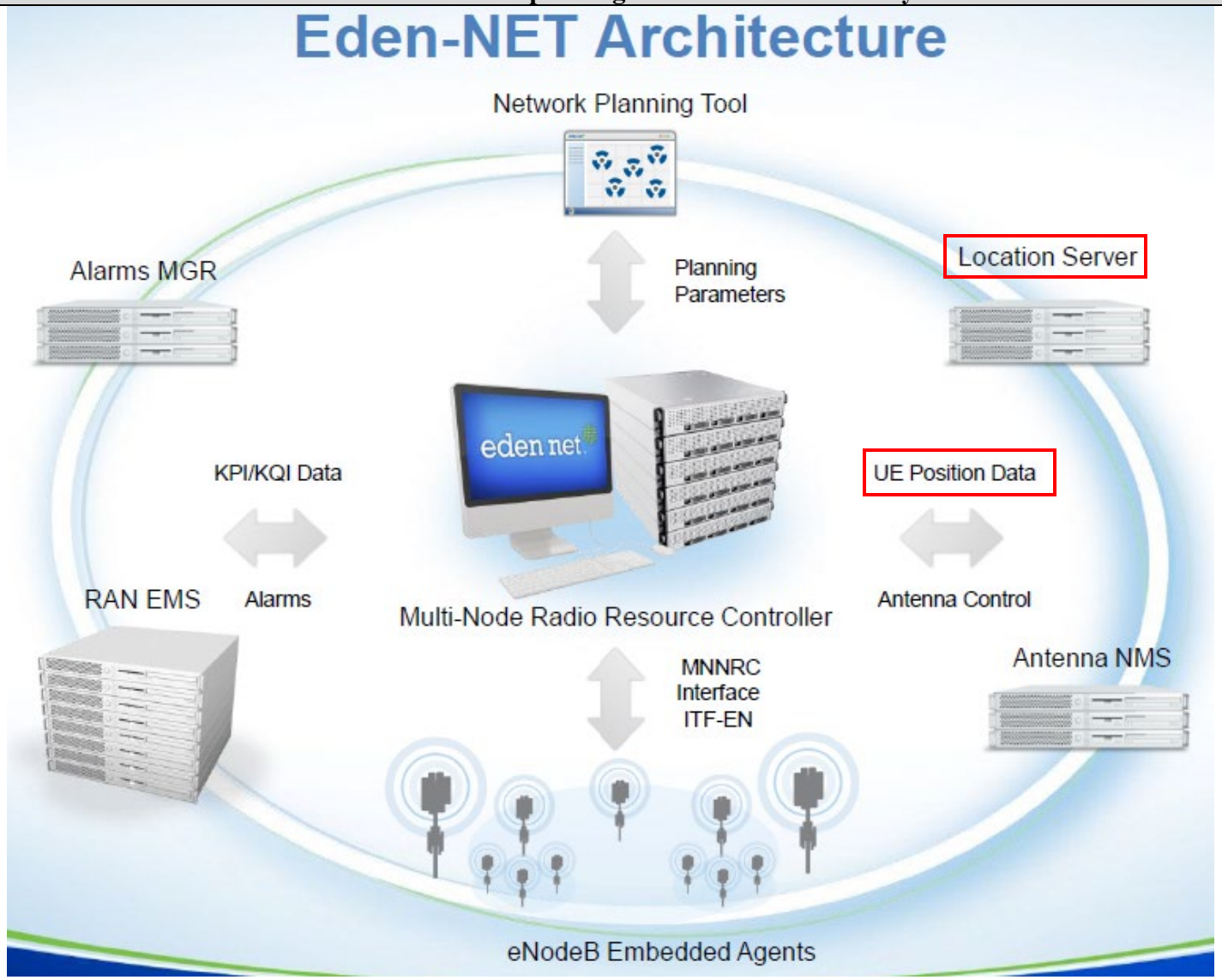
INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



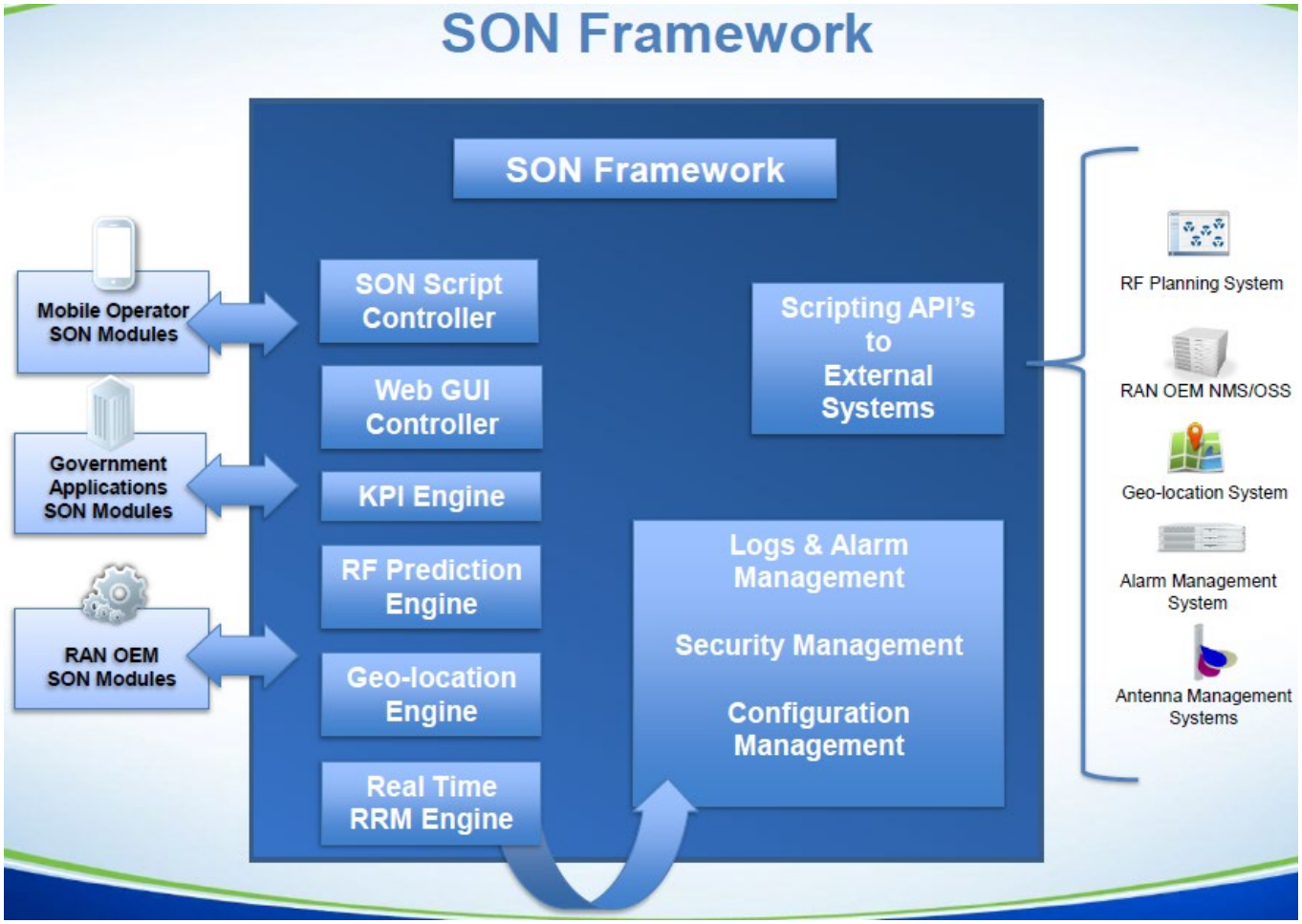
Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 37.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	 **Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 38.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

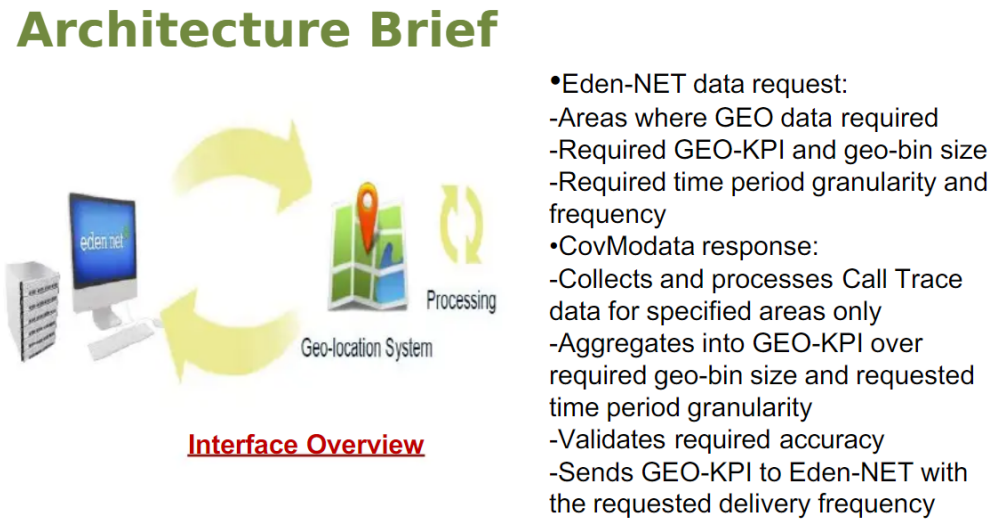
Claim 1	Corresponding Structure in Accused Systems



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 39.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 22 (Integration Discussion withNokia Eden Rock SON (2016)) at 2.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Eden-NET OSS Level SON Solution

New Layer of Cloud Software Intelligence for 2G, 3G, and 4G Networks.

OSS Level SON Framework

- SON Operating System
- Supports Modular SON Application Modules
- Multi-Vendor Support via Extensible Drivers
- Multi-Technology SON Solution (2G, 3G, 4G)

Extensive SON Module Library

- Pre-engineered SON Modules Cover Major 3GPP/NGMN SON Use Cases
- Custom User Defined Modules Supported via Open SON Scripting

Complete OSS Level SON Automation

- Map Based SON Configuration
- Robust SON Security and Management Features
- Intuitive Web based SON Control Panel

10 Nokia Internal Use OS8461-16A-NRM © Nokia 2017 NOKIA

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 9.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

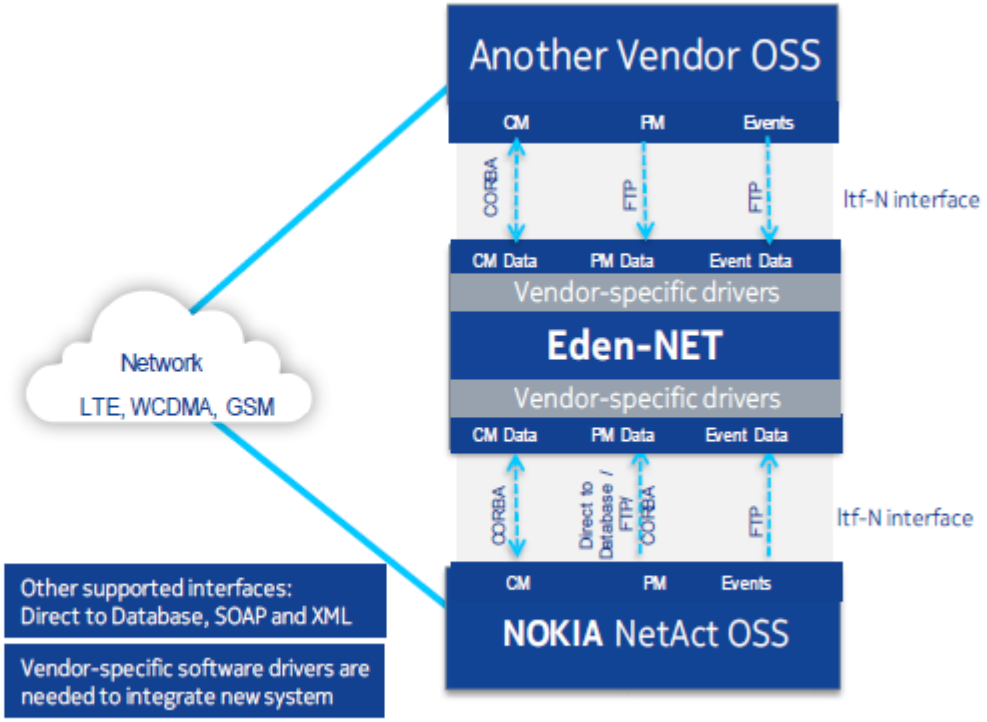
Claim 1	Corresponding Structure in Accused Systems

Eden-NET Centralized SON Server OSS Interfaces

Configuration Management (CM)
- CM data retrieved and pushed over CORBA interface

Performance Monitoring (PM) data
- PM data retrieved via FTP, CORBA or via direct data base access for NetAct
- Other vendor example - PM data retrieved via FTP for Ericsson OSS-RC

Event Data
- NOKIA Megamon data retrieved via FTP
- Other vendor example - Ericsson GPEH data retrieved via FTP



13 Nokia Internal Use OS8461-16A-NRM © Nokia 2017 NOKIA

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 12.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	WHAT TYPES OF INFORMATION WE COLLECT ABOUT YOU ↑ top We collect information about you and your associated device(s) when you use our products or services or otherwise interact with us or with third-party services through our products and services. Examples of the types of information we collect include: **Personal Information** "Personal Information" means information that we directly associate with a specific person or entity (for example, name; addresses; telephone numbers; email address; Social Security Number; call records; wireless device location). Personal information does not include "de-identified," "anonymous," or "aggregate" information – which are not associated with a specific person or entity. **Customer Proprietary Network Information (CPNI)** Customer Proprietary Network Information, or "CPNI", is a subset of Personal Information that is generated in connection with the telecommunications services we provide to you. CPNI includes, for example, call details, call location information, and certain information about your rate plans and features. CPNI does not include your name, address, and phone number. **Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 4.** **Information We Collect Automatically** We automatically collect a variety of information associated with your use of your device (on our network, when roaming, or in WiFi mode) and our products and services, some of which may be associated with you or another user on your account. …

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	For example some of the ways we may automatically collect information include: • Our systems capture details about the type and location of wireless device(s) you use, when the device is turned on, calls and text messages you send and receive (but we do not retain the content of those calls or messages after delivery), and other data services you use. • We may also gather information about the performance of your device and our network. Some examples of the types of data collected include: the applications on the device, signal strength, dropped calls, data failures, and other device or network performance issues. **Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 6.** **Location-Based Services** We use location information to route wireless communications and to provide 911 service, which allows emergency services to locate your general location. We may disclose, without your consent, the approximate location of a wireless device to a governmental entity or law enforcement authority when we are served with lawful process or reasonably believe there is an emergency involving risk of death or serious physical harm. Depending on your device, you may also be able to obtain a wide array of services based on the location of your device (for example, driving directions, enhanced 411 Directory Assistance, Find My Device, or search results, etc.). These data services, known as Location-Based Services ("LBS") are made available by us and others, usually via applications. These services use various location technologies and acquire location data from various sources. These applications and services use various location technologies (including Global Positioning Satellite ("GPS"), Assisted GPS ("AGPS"), cell ID and enhanced cell ID technologies) to identify the approximate location of a device, which is then used in conjunction with the application to enhance the user's experience (for example, to provide driving directions, to provide enhanced 411 Directory Assistance, or search results, etc.) **Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 8 and 9.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	Observed Time Difference of Arrival OTDOA is an LTE network based, multilateration method in which a handset measures the time difference between specific signals sent from base stations within its vicinity; the handset then reports these time differences to its affiliated wireless network. The network then uses these time differences in conjunction with the location of the applicable base stations to calculate a location estimate of the 9-1-1 caller. OTDOA technology increases T-Mobile's ability to remain compliant on its LTE network in areas where the primary positioning method AGPS does not work, for example in some indoor locations and dense urban areas. T-Mobile has completed deployment of OTDOA technology across its LTE network and is continually optimizing the OTDOA network to increase accuracy and availability of reported positions. T-Mobile has also deployed additional functionality on its LTE Location Server to enhance the accuracy and availability of OTDOA, such as Positioning Resource Signal muting and Inter-frequency OTDOA, as these features have been standardized and made available for implementation. T-Mobile has developed in-house tools to improve the accuracy of site level provisioned parameters, and to detect and correct provisioning errors. Increasing the accuracy of provisioned data, and calibrating out cable delays, optimizes achievable accuracy from this important new location technology. **Attachment 2 (T-Mobile's Implementation Plan and 18 Month Status Report For Implementing the Federal Communication Commission's Fourth Report and Order on Wireless E911 Location Accuracy Requirements (2017)) at 16 and 17.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	T-Mobile has invested resources to upgrade its UMTS and LTE Location Servers to support GLONASS satellite functionality, in addition to AGPS. It is well known that adding a 2nd satellite constellation can significantly improve both accuracy and availability of the resulting location estimates, especially in many challenging indoor environments. Moreover, T-Mobile's systems include processes to disable network-based location measurements received through GLONASS for location estimate calculations as needed. T-Mobile has not begun to utilize this newly available functionality to improve 9-1-1 location performance, pending receive-only authorization from the FCC. **Attachment 2 (T-Mobile's Implementation Plan and 18 Month Status Report For Implementing the Federal Communication Commission's Fourth Report and Order on Wireless E911 Location Accuracy Requirements (2017)) at 17.** **Location Services** **Location-Based Services** Would you use a mobile application (downloaded to your mobile phone/device) that helped you find the nearest gas station, sent your device e-coupons for nearby shops, warned you when your teenager leaves a pre-set geographic area, or allows you and your friends to locate one another on an interactive map? From the relatively mundane to the cutting edge, Location Based Services ("LBS") have arrived. Driven by the recent availability of mobile devices capable of running downloadable applications (e.g., smartphones and other 3rd generation ("3G") network devices), the potential uses of device location to improve users' overall mobile experience is virtually limitless. But, as with any technology, LBS carries with it certain risks – including the potential for misuse. No mobile device user should be "tracked" without their knowledge and consent (or in the case of minors or employees provided a device by their parents or employers, respectively, at least without the user's knowledge). It's therefore critical that mobile device users be aware of how their device location is being gathered, used, and shared – and by whom! **Attachment 8 (About T-Mobile – Location Services (Webpage, 2014)) at 2 of 6.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	Network Location The use of mobile device location is not new – it's always been used by wireless carriers to provide mobile service. Indeed, in order for mobile communications to work, the carrier (e.g., T-Mobile) must remain aware of the approximate location of all mobile devices using the carrier's network. This is how the carrier is able to route wireless communications (calls, text messages, etc.) to and from the devices even as they are moving. It's also how carriers provide enhanced 9-1-1 ("E9-1-1") service for mobile devices – i.e., allowing carriers to provide approximate device location to emergency officials in response to a 9-1-1 call made from a mobile device. In other words, whenever a mobile device is turned on and is within range of a carrier's cell tower(s), the device sends periodic signals that are read by those tower(s). Communications directed to or from the device are then routed to the nearest cell tower, and as the device moves closer to a different tower, the carrier's network redirects the communications to the new tower. Only recently have on-device applications progressed to the point of using such network-based location information to facilitate the application. Thus, for example, by identifying the zip code of the cell tower to which the mobile device is currently connected, the weather forecast displayed on a mobile web page can be easily customized based on current location – as opposed to requiring the user's entry of the location or defaulting to a preset address. Similarly, a search entered on a mobile search engine can be automatically enhanced to provide the most geographically relevant results. (E.g., if searching for pizza, the results can focus on the zip code in which the device is currently operating.) It should be noted, however, that due to technical constraints, the network-based location data is not always precise – ranging from simply the location of the nearest cell tower to within tens of meters of the device – depending on various factors. **Satellite Location** Many newer mobile devices also contain a built-in Global Positioning Satellite ("GPS") component (similar to navigation systems in automobiles). These GPS-enabled devices measure distances from various government-owned satellites to pinpoint the device location. Once the device identifies its own location, that information can be utilized by an application (e.g., a mapping program to provide driving directions) or it can be communicated to others (e.g., a social networking application that shares current location among friends) using the ordinary communication protocols of the device. GPS location data can be incredibly accurate – with precision measured within a few feet. **Attachment 8 (About T-Mobile – Location Services (Webpage, 2014)) at 2 & 3 of 6.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

5.3 LTE1049: MDT - UE Measurement Logs

5.3.1 Description of LTE1049: MDT - UE Measurement Logs

Introduction to the feature

The *LTE1049: MDT - UE Measurement Logs* feature allows the eNodeB to support the configuration and retrieval of user equipment (UE) measurement logs as well as to report those with a cell trace.

…

operators. A minimization of drive tests (MDT) has been proposed in order to meet operator requirements. It is a method of collecting the DT data directly from regular UEs used in the network; it is a less expensive approach to DTs. There are two modes of MDT measurements:

…

The UE measurement logs contain the following information:

- location info (global navigation satellite system (GNSS) information is optional for the UE)
- time stamp
- serving cell ID
- serving cell measurements
- neighbor cell measurements

Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 308 and 309.

3.4 LTE951: Enhanced Cell ID Location Service

3.4.1 Description of LTE951: Enhanced Cell ID Location Service

Introduction to the feature

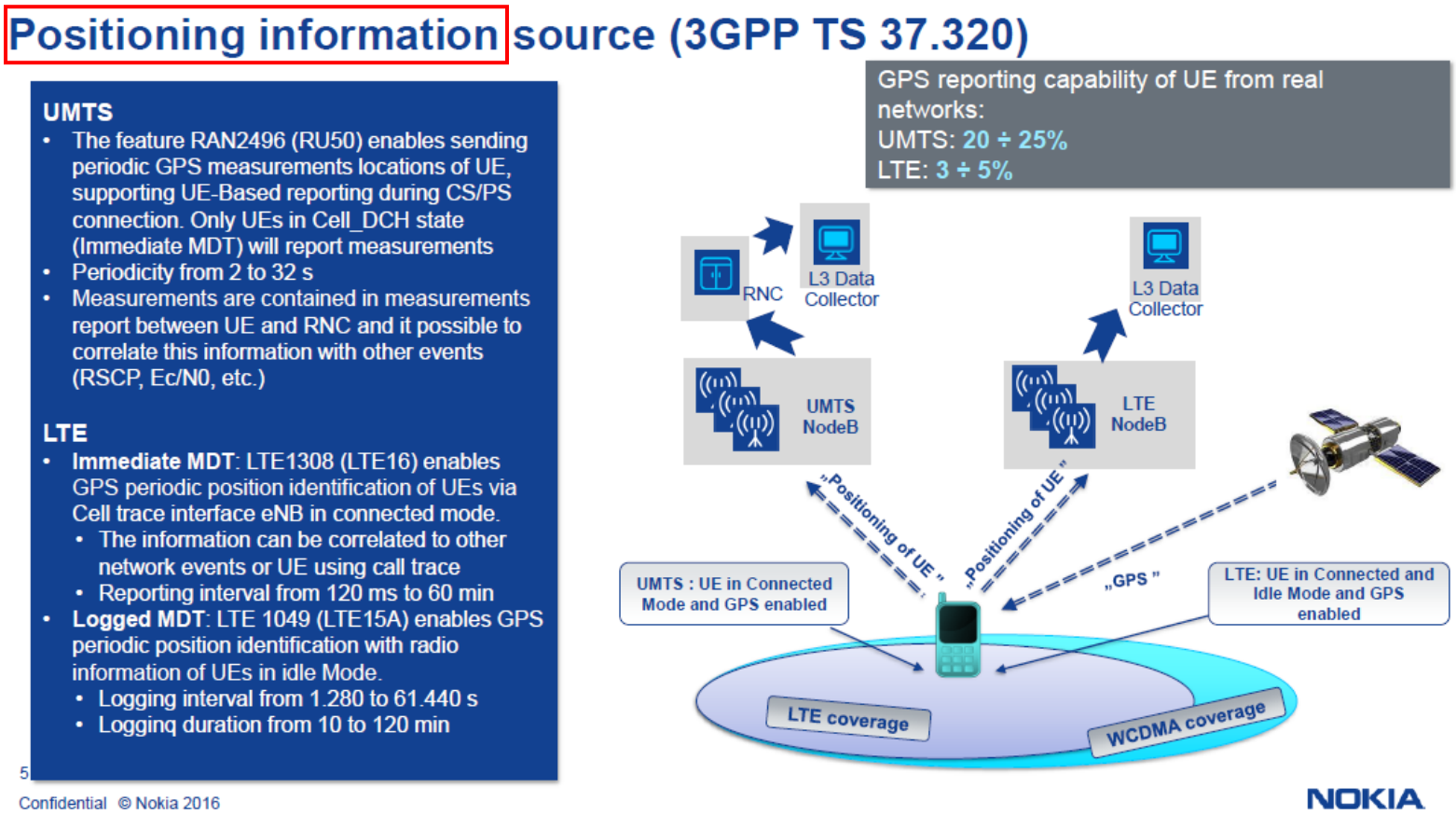
The *LTE951: Enhanced Cell ID Location Service* feature improves location reporting by introducing enhanced cell ID reporting (E-CID) to the E-Serving Mobile Location Center (E-SMLC).

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	End-user benefits This feature: • enables determining UE position in case of emergency calls • enables using applications requesting UE positioning (for example maps, etc.) **Operator benefits** This feature allows the operator to turn the location services in a cell on and off. … Providing the operator's network contains a mobility management entity (MME) and E-SMLC provided by other vendors, it is assumed that these network elements support the LPPa messaging for E-CID before the *LTE951: Enhanced Cell ID Location Service* feature is deployed. It is also assumed that any timers on the MME and E-SMLC (that are preventing message response timeouts) can be adjusted as they are needed to ensure successful inter-operability with Nokiaan eNB. **Functional description** **Functional overview** The *LTE951: Enhanced Cell ID Location Service* feature introduces enhanced cell ID (E-CID) location services. The location service is performed in two steps: 1. The UE is positioned based on its serving cell's ID. 2. The UE is positioned more accurately inside a single cell, using one of the following four methods: • Timing advance type 1 • Timing advance type 2 • Intra-frequency Reference Signal Received Power (RSRP) and/or Reference Signal Received Quality (RSRQ) **Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 63 and 64.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 5.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

1. T-Mobile's Wireless Network Services and Customer Location Information

12. T-Mobile provides mobile voice and data services to consumers throughout the United States by enabling consumer mobile phones to make and receive calls or transmit data on T-Mobile's wireless network.[43] The mobile phones of T-Mobile subscribers, like those of customers of other carriers, periodically register with nearby network signal towers.[44] T-Mobile uses the information generated from this registration activity to ensure the proper functioning of its network and to provide the services to which its customers subscribe.[45] Because T-Mobile knows the location of its network signal towers, T-Mobile is able to calculate the approximate geographic location of the mobile phones communicating with its towers.[46] This type of location information—which is created even when the customer does not have an active established connection, such as a voice call or data usage—may at times be helpful to consumers. For example, in emergencies, the location of a customer's mobile phone can enable first responders and law enforcement to assist. Location information is also used for non-emergency location-based services, such as roadside assistance, delivery tracking, and fraud prevention.[47] Other widely used

43. The customer location information at issue here meets these two criteria. *First*, it relates to the location of a telecommunications service, i.e., T-Mobile's commercial mobile service.[124] The location data was derived from the wireless mobile devices of T-Mobile's customers communicating with nearby network signal towers to signal the location of those devices. A wireless mobile device undergoes an authentication and attachment process to the carrier's network, via the closest towers. After a mobile device is authenticated and logically attached to a wireless network, it may be (1) connected (sending/receiving data/voice) or (2) idle. In either state, the carrier must be aware of and use the device's location in order for it to enable customers to send and receive calls. T-Mobile is therefore providing telecommunications service to these customers whenever it is enabling the customer's device to send and receive calls—regardless of whether the device is actively in use for a call. This view finds ample support in Commission precedent, including the *2013 CPNI Declaratory Ruling*, which indicates that the policy considerations remain the same throughout a consumer's use of a mobile device, including the entire process through which the device stands ready to make or receive a call.[125]

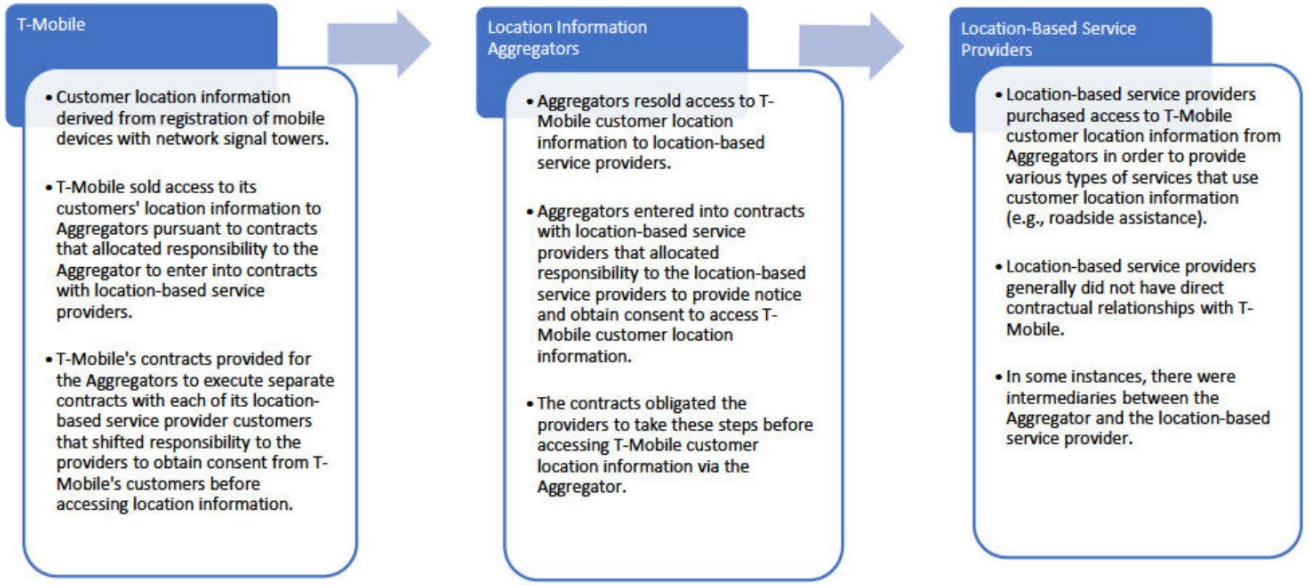
Attachment 18 (Federal Communications Commission (2020)) at 6, 15 & 16.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

2. T-Mobile's Location-Based Services Business Model

13. Until February 8, 2019, T-Mobile provided location-based service providers access to its customers' location information through a chain of contract-based business arrangements.[49] T-Mobile sold access to customer location information to companies known as "location information aggregators," who then resold access to such information to third-party location-based service providers or in some cases to intermediary companies who then resold access to such information to location-based service providers. T-Mobile had arrangements with two aggregators: LocationSmart and Zumigo (the Aggregators).[50] Each Aggregator, in turn, had arrangements with numerous location-based service providers. The most basic form of these relationships is illustrated in Fig. 1:



Attachment 18 (Federal Communications Commission (2020)) at 7.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	15. T-Mobile asserts that it structured its location-based services program "such that only two entities," the Aggregators, had "direct access to the [T-Mobile Service Delivery Gateway] and thus to T-Mobile customer location data," subject to certain "contractual, procedural, and technical safeguards."[52] According to T-Mobile, the Service Delivery Gateway is a platform that provides access to internal T-Mobile application programming interfaces, including "Location APIs" which the Aggregators used to request T-Mobile customer location information.[53] T-Mobile explains that the Aggregators, in turn, contracted with location-based service providers.[54] T-Mobile did not have contracts with the location-based service providers to which it permitted the Aggregators to disclose its customers' location information. [65] LOI Response at T-MOBILE00013594, Response to Request for Documents No. 3, 2014 Location Aggregator License Agreement between T-Mobile and TechnoCom Corporation d/b/a LocationSmart (executed on May 20, 2014, by Stephen Leptich, Sr., Corporate Counsel, for T-Mobile USA, Inc., and by Mario Proietti, CEO for LocationSmart), Sections 7.2-3 (T-Mobile-LocationSmart Agreement); LOI Response at TMOBILE0001230, Response to Request for Documents No. 3, 2014 Location Aggregator License Agreement between T-Mobile and Zumigo, Inc. (executed on Feb. 11, 2014, by Stephen Leptich, Sr., Corporate Counsel, for T-Mobile USA, Inc., and by Chirag Bakshi, CEO for Zumigo), Sections 7.2-3 (T-Mobile-Zumigo Agreement). 61. *First*, T-Mobile asserts that it safeguarded customer location information by allowing only two entities—the Aggregators LocationSmart and Zumigo—direct access to its Service Delivery Gateway.[157] T-Mobile required these entities, in turn, to impose a number of contractual safeguards on the location-based service providers to whom they provided customer location information.[158] T-Mobile presents this arrangement as a safety feature: only two entities had access to its customer location data through its Location APIs.[159] But while that arrangement may have limited the number of parties with *direct* access to its location data, the effect of this arrangement was that the myriad location-based service providers that actually requested and used the location information of T-Mobile customers had no direct contractual relationship with T-Mobile. As a result, T-Mobile could only govern the behavior of the **Attachment 18 (Federal Communications Commission (2020)) at 8, 9 & 20.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	A wave of media investigations in 2018 found that between 2012 and 2017, location data from carriers, including T-Mobile, AT&T and Sprint, had been captured by a so-called location aggregator called Locaid (later renamed LocationSmart). LocationSmart then sold that data to a number of different companies, including CerCareOne. In turn, CerCareOne sold the data to bounty hunters and bail bondsmen, enabling them to find the real-time location of mobile phones. T-Mobile said it had also contracted with LocationSmart and Zumigo as location aggregators. In its letter to the FCC, T-Mobile's SVP of government affairs, Kathleen O'Brien Ham, said the company's location aggregator program was "always relatively small" and that it governed how its customer location data was used by both the aggregators and the downstream location-based service (LBS) providers through "contracts, service use approvals, and periodic assessments conducted by an outside audit firm at the direction of T-Mobile's counsel." After initiating an evaluation of its location aggregator program in the summer of 2018, T-Mobile said it decided to terminate the program entirely, and began phasing out its location data aggregator agreements in October 2018. As of February 8, 2019, T-Mobile said it had terminated all LBS provider access to location data under the program. T-Mobile's contracts with aggregators LocationSmart and Zumigo expired March 9, 2019. **Attachment 23 (Wireless carriers tell FCC they stopped selling user location data to aggregators _ Fierce Wireless (Webpage, 2019)) at 2.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

LocationSmart

From Wikipedia, the free encyclopedia

LocationSmart, originally called **TechnoCom Location Platform**, is a location-as-a-service (LaaS) company based in Carlsbad, California, that provides location APIs to enterprises and operates a secure, cloud-based and privacy-protected platform. In February 2015, it acquired a competitor, Locaid.[1][2]

LocationSmart provides near real-time location data for devices including smartphones, feature phones, tablets, M2M, IoT and other connected devices on Tier 1 and Tier 2 wireless networks in the U.S. and Canada. This includes AT&T,[3] Verizon Wireless,[4] T-Mobile US, Sprint Corporation,[5] MetroPCS, U.S. Cellular, Rogers Communications, Bell Canada and Telus.[6]

Attachment 24 (LocationSmart – Wikipedia (webpage, 2022)) at 1.

LocationSmart enables enterprises to reach more than 15 billion devices worldwide through its cross-carrier mobile network location, Cell ID, Wi-Fi and IP geolocation databases, mobile app SDKs, and suite of location services. Its services are available for smartphones, tablets, feature phones, M2M and virtually all other connected device types. With the expansive reach offered by LocationSmart, contact center operators are equipped to quickly deploy pervasive location-based solutions. Additionally, customers receive access to LocationSmart's intuitively designed client portal and its dedicated customer success team for 24/7 support.

About LocationSmart

LocationSmart is the worldwide Cloud Location Services market leader for connected devices. We provide the easiest and most comprehensive cross-carrier platform for local, hyper-local and context-aware application development. Our core location services span indoor and outdoor use across devices, platforms and carrier networks including AT&T, Sprint, T-Mobile, US Cellular and Verizon. Powering innovative solutions for Fortune 500 customers and start-ups alike, LocationSmart is changing the ways companies do business. We deliver the broadest reach and largest global footprint, with an extensive portfolio of privacy consent methods for easy end user adoption. For more information, please visit www.locationsmart.com.

Attachment 25 (LocationSmart Announces Availability of its Geolocation Platform APIs on Genesys AppFoundry (2016)) at 1 & 2.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

TeleCommunication Systems Selects Locaid as Location-as-a-Service Partner

TeleCommunication Systems Selects Locaid as Location-as-a-Service Partner

Note: Comtech Acquired TCS on 2/23/2016

SAN FRANCISCO and ANNAPOLIS, Md., May 3, 2012 /PRNewswire/ -- Locaid, the world's largest Location-as-a-Service company, and TeleCommunication Systems, Inc. (TCS) (NASDAQ: TSYS), a world leader in highly reliable and secure mobile communication technology, today announced that TCS' portfolio of mobile location-based products and services (LBS) will now incorporate Locaid's Location-as-a-Service capabilities. This partnership provides wireless operators with access to rapidly deployable location technology for additional financial yield from their location infrastructure.

The TCS - Locaid partnership is an industry first that brings a turn-key LBS solution that includes location network capabilities via TCS' proven Xypoint® Mobile Positioning Center (MPC) or Xypoint Gateway Mobile Location Center (GMLC) platforms and cross-carrier, multi-source, location aggregation enablement. Through this partnership, Locaid's aggregation solution integrates with TCS' market-leading network location platforms and enables wireless operators to rapidly enhance their monetization of a location technology investment. Further, TCS facilities enable hybrids of in-network, hosted or managed services location platforms and cloud-based location aggregation enablement.

Locaid President and CEO Rip Gerber stated, "TCS is known for providing carriers with new revenue opportunities and delivering them in a rapidly deployable, hosted and turn-key way. This agreement is testimony to the importance of Location-as-a-Service among the biggest players in mobile, and it is an historic first step between our two companies."

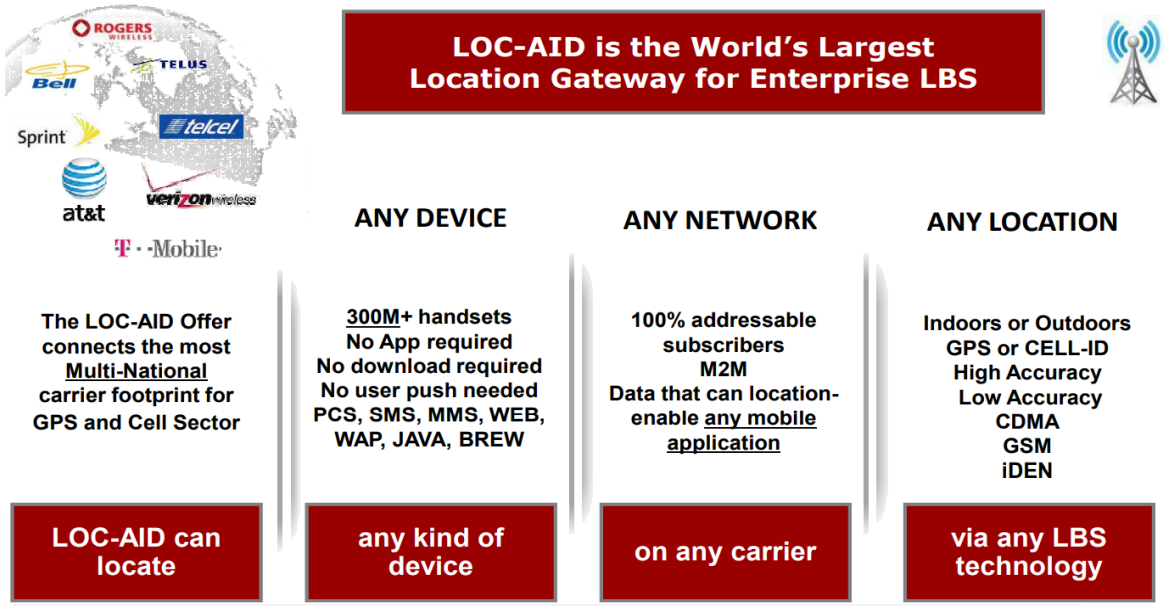
ABOUT LOCAID

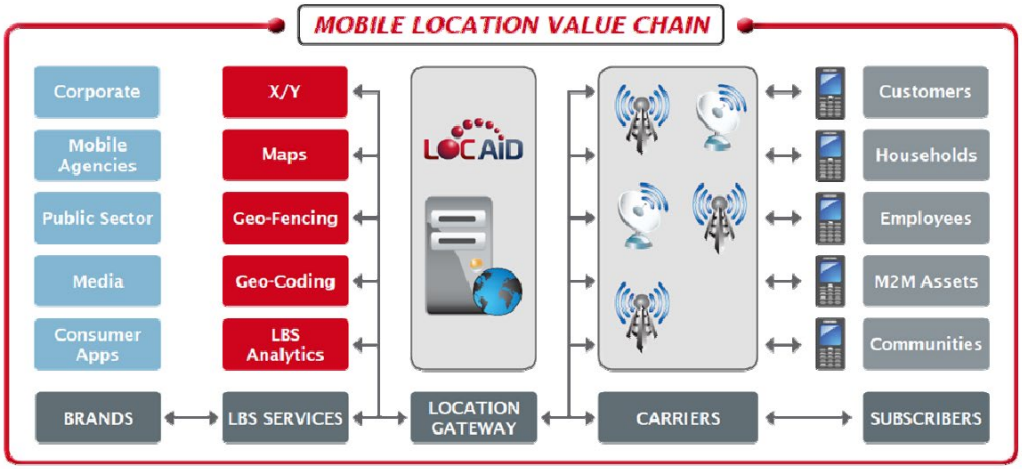
Locaid is the world's largest Location-as-a-Service (LaaS) company. We operate a location privacy platform that allows mobile developers to locate over 350 million devices for enterprise authentication, fraud management, consumer location services and opt-in mobile marketing. Locaid locates smartphones, feature phones, tablets and any mobile device on leading wireless carriers including America Movil, AT&T, Rogers, Sprint, T-Mobile, TELUS and Verizon Wireless. Locaid also helps shape and enforce location privacy policies via leadership roles on governing associations including the CTIA, MMA and IAPP. The largest financial institutions, mobile marketers, M2M platforms and mobile service providers get network location from Locaid. Location Matters.™ You can locate us at http://www.loc-aid.com, @locaid and www.facebook.com/Locaid.

Attachment 19 (TeleCommunication Systems Selects Locaid as Location-as-a-Service Partner Comtech Telecommunications Corp (2016)) at 1.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems





Attachment 20 (locaid Mobile Location Overview (2011)) at 2 & 3.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

LOC-AID has developed a unique strategy for delivering network-based location information and value-added services geared toward creating new revenue streams for our developers.

- Network-based location techniques utilize the carrier network infrastructure (Cell towers) to identify the location of the wireless device.
- Carrier network-based location information offers some significant advantages:
  - ✓ The ability to access precise (Assisted GPS) and course (Cell ID) location data
  - ✓ No device dependency – Operating Systems, GPS, Smartphone or Feature Phone
  - ✓ No device or interaction required (Cell ID)
  - ✓ No user download required (Cell ID)
  - ✓ Secure and can not be manipulated like GPS location on smartphones

Cell ID

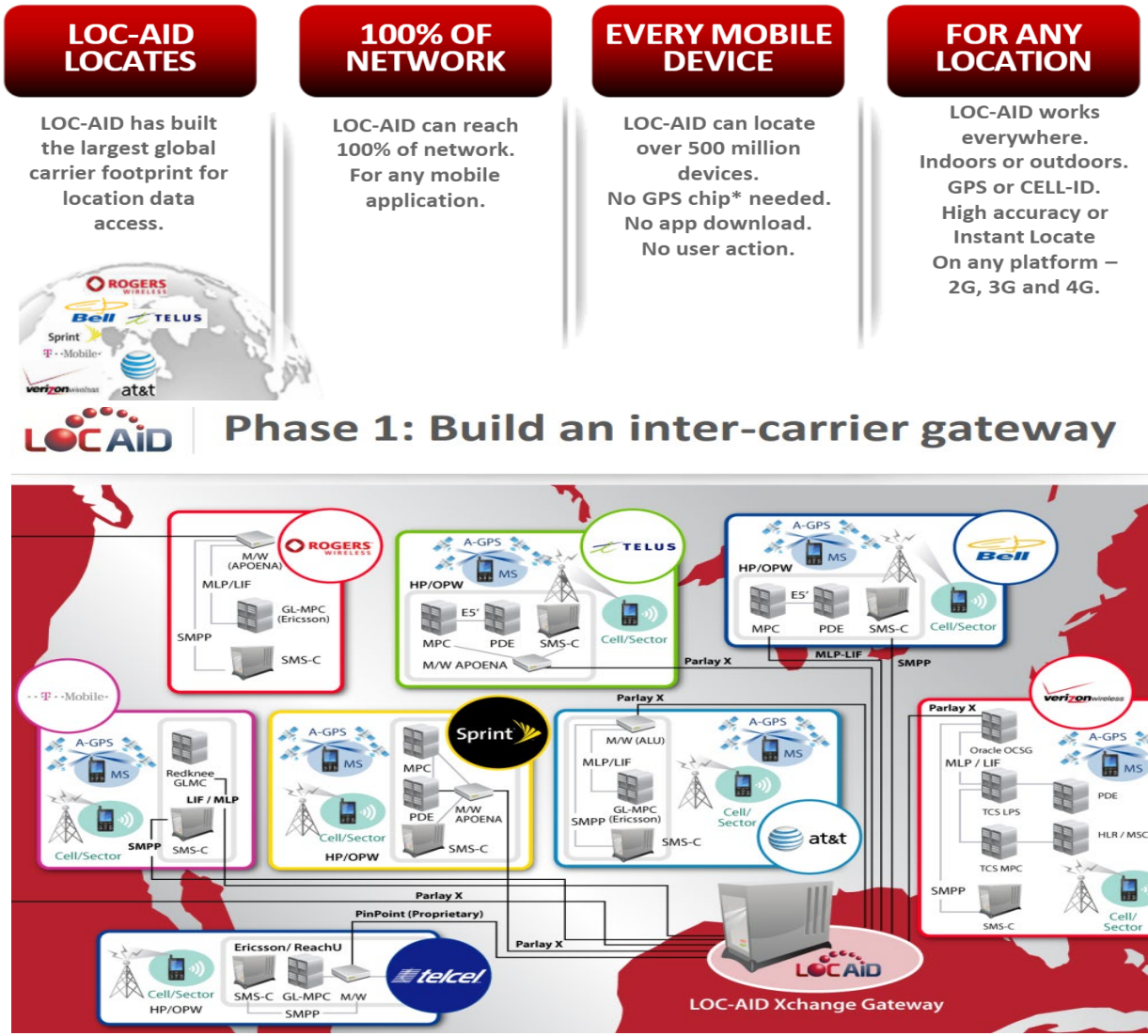
Uses the cell site and the respective sector to report estimated latitude and longitude

- **Accuracy** = 100M+ Can be as accurate as 100M in metropolitan cities like New York City
- **Speed**: Fastest method to return a location, approx 3-10 Sec
- **Advantages**: Fastest, can locate any device type
- **Disadvantages**: Accuracy depends on density of cell towers.

Attachment 20 (locaid Mobile Location Overview (2011)) at 5 & 6.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 21 (overview-of-lbs-for-the-enterprise (2011)) at 1 & 7.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

About Location Labs

Location Labs, is the leader in Location-as-a-Service for mobile application developers. The company's location based services Platform helps developers leverage location information to help create intelligent location aware applications, while the company's Location Privacy Service allows consumers to set and control the kind of location information they share with these applications. The company's Platform supports both smart phones as well over 180MM other non-smart phones on the market today. Location Labs has strategic partnerships with AT&T, Sprint-Nextel, T-Mobile, Qualcomm, Intel, as well as a number of other global partners. The company has raised $26MM in venture financing, from Draper Fisher Jurvetson, BlueRun Ventures (formerly Nokia Venture Partners), QUALCOMM Ventures, Intel Capital, British Telecom and Mitsui Ventures. Location Labs was formerly operating as WaveMarket, Inc.

More information: http://www.location-labs.com

Attachment 26 (Location Labs Launches Location-as-a-Service Platform (2010)) at 3.

But WaveMarket, which today is renaming itself Location Labs, is offering developers a new way to gather location data from phones: directly from the carriers themselves.

The mobile carriers obviously can collect location data on any phone on their networks. But it is not easy for developers to work with the carriers to access that data, and the carriers charge money for it. Location Labs already works with AT&T, Sprint, and T-Mobile in the U.S. (but not yet with Verizon) and is offering geo-location APIs which tap directly into their cellular network infrastructure. "This platform can locate 180 million phones with a remote API, no download required," says CEO Tasso Roumeliotis. Instead, the location data is all server-based.

For smartphone app developers, the geo-fencing API might be worth a look. It helps reduce the battery drain for geo apps running in the background. On Android and Blackberry, for instance, not a lot geo apps take advantage of the background processing because it kills the battery in a few hours. Location Labs looks at the RF signals to figure out when to request new geo-information instead of asking all the time. If you are a mobile app developer who tries out these APIs, please let others know your thoughts below in comments.

Attachment 27 (Location Labs (Formerly WaveMarket) Gives Mobile Apps Geo Data Without A Download (2010)) at 1 & 2.

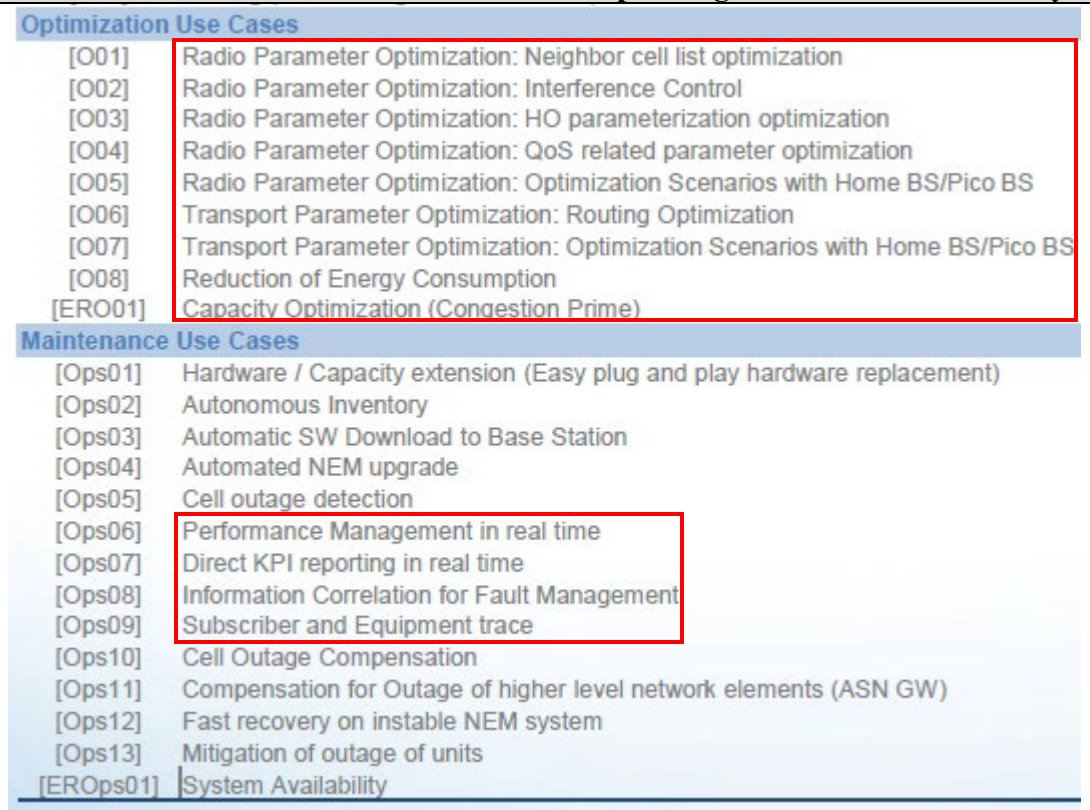
INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
w herein the system of computers further receives and stores performance data of connections between the at least one mobile wireless communications device and the at least one radio frequency transceiver along with the indication of the location,	Plaintiff contends that the system of computers executing or loaded with Nokia Eden-Net solution; and operating, implementing and supporting SON solution in the wireless telecommunications network, corresponds to this claim limitation, as the system of computers executing or loaded with Nokia Eden-Net solution receives performance data of connections between the one or more mobile wireless communications devices and radio frequency transceivers (i.e., base-stations or radio towers) from the MDT (Minimization of Drive Tests) reports, UE Measurement Reports, etc. and stores the performance data along with indication of the location. Nokia Eden-Net software codes are programmed to store the performance data and corresponding location for a wireless device in a memory associated with the system of computers because the software codes are programmed to collect performance measurements pertaining to qualitative and quantitative aspects of the operation of wireless network. The system of computers installed or compatible with Nokia Eden-Net solution routinely receives performance measurements pertaining to qualitative and quantitative aspects (for example, expressed in terms of Key Performance Indicators or KPIs, Performance Statistics, Performance Indicator, etc.) of RF-based interactions between the UEs and the base-stations which can include performance data along with location information of mobile wireless communications devices. Further, the collected data is stored in a cache. The following exemplifies this limitation's existence in Accused Systems: **Information We Collect Automatically** We automatically collect a variety of information associated with your use of your device (on our network, when roaming, or in WiFi mode) and our products and services, some of which may be associated with you or another user on your account. … For example some of the ways we may automatically collect information include: • Our systems capture details about the type and location of wireless device(s) you use, when the device is turned on, calls and text messages you send and receive (but we do not retain the content of those calls or messages after delivery), and other data services you use. • We may also gather information about the performance of your device and our network. Some examples of the types of data collected include: the applications on the device, signal strength, dropped calls, data failures, and other device or network performance issues. **Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 6.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	Location-Based Services We use location information to route wireless communications and to provide 911 service, which allows emergency services to locate your general location. We may disclose, without your consent, the approximate location of a wireless device to a governmental entity or law enforcement authority when we are served with lawful process or reasonably believe there is an emergency involving risk of death or serious physical harm. Depending on your device, you may also be able to obtain a wide array of services based on the location of your device (for example, driving directions, enhanced 411 Directory Assistance, Find My Device, or search results, etc.). These data services, known as Location-Based Services ("LBS") are made available by us and others, usually via applications. These services use various location technologies and acquire location data from various sources. These applications and services use various location technologies (including Global Positioning Satellite ("GPS"), Assisted GPS ("AGPS"), cell ID and enhanced cell ID technologies) to identify the approximate location of a device, which is then used in conjunction with the application to enhance the user's experience (for example, to provide driving directions, to provide enhanced 411 Directory Assistance, or search results, etc.) **Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 8 and 9.** **Location Data** We may collect your device's location whenever it is turned on (subject to coverage limitations). **Performance and Diagnostic Data** We may collect performance and diagnostic data about your use of our network, networks you roam on, WiFi services or your device. For example, we may collect information about the performance of the device, signal strength, dropped calls, data failures, battery strength and other device or network performance issues. We may also collect information about applications on your device, the fact that an application has been added, when an application is launched or fails to launch, and length of time an application has been running. **Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 5.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	

Optimization Use Cases	
[O01]	Radio Parameter Optimization: Neighbor cell list optimization
[O02]	Radio Parameter Optimization: Interference Control
[O03]	Radio Parameter Optimization: HO parameterization optimization
[O04]	Radio Parameter Optimization: QoS related parameter optimization
[O05]	Radio Parameter Optimization: Optimization Scenarios with Home BS/Pico BS
[O06]	Transport Parameter Optimization: Routing Optimization
[O07]	Transport Parameter Optimization: Optimization Scenarios with Home BS/Pico BS
[O08]	Reduction of Energy Consumption
[ERO01]	Capacity Optimization (Congestion Prime)
Maintenance Use Cases	
[Ops01]	Hardware / Capacity extension (Easy plug and play hardware replacement)
[Ops02]	Autonomous Inventory
[Ops03]	Automatic SW Download to Base Station
[Ops04]	Automated NEM upgrade
[Ops05]	Cell outage detection
[Ops06]	Performance Management in real time
[Ops07]	Direct KPI reporting in real time
[Ops08]	Information Correlation for Fault Management
[Ops09]	Subscriber and Equipment trace
[Ops10]	Cell Outage Compensation
[Ops11]	Compensation for Outage of higher level network elements (ASN GW)
[Ops12]	Fast recovery on instable NEM system
[Ops13]	Mitigation of outage of units
[EROps01]	System Availability

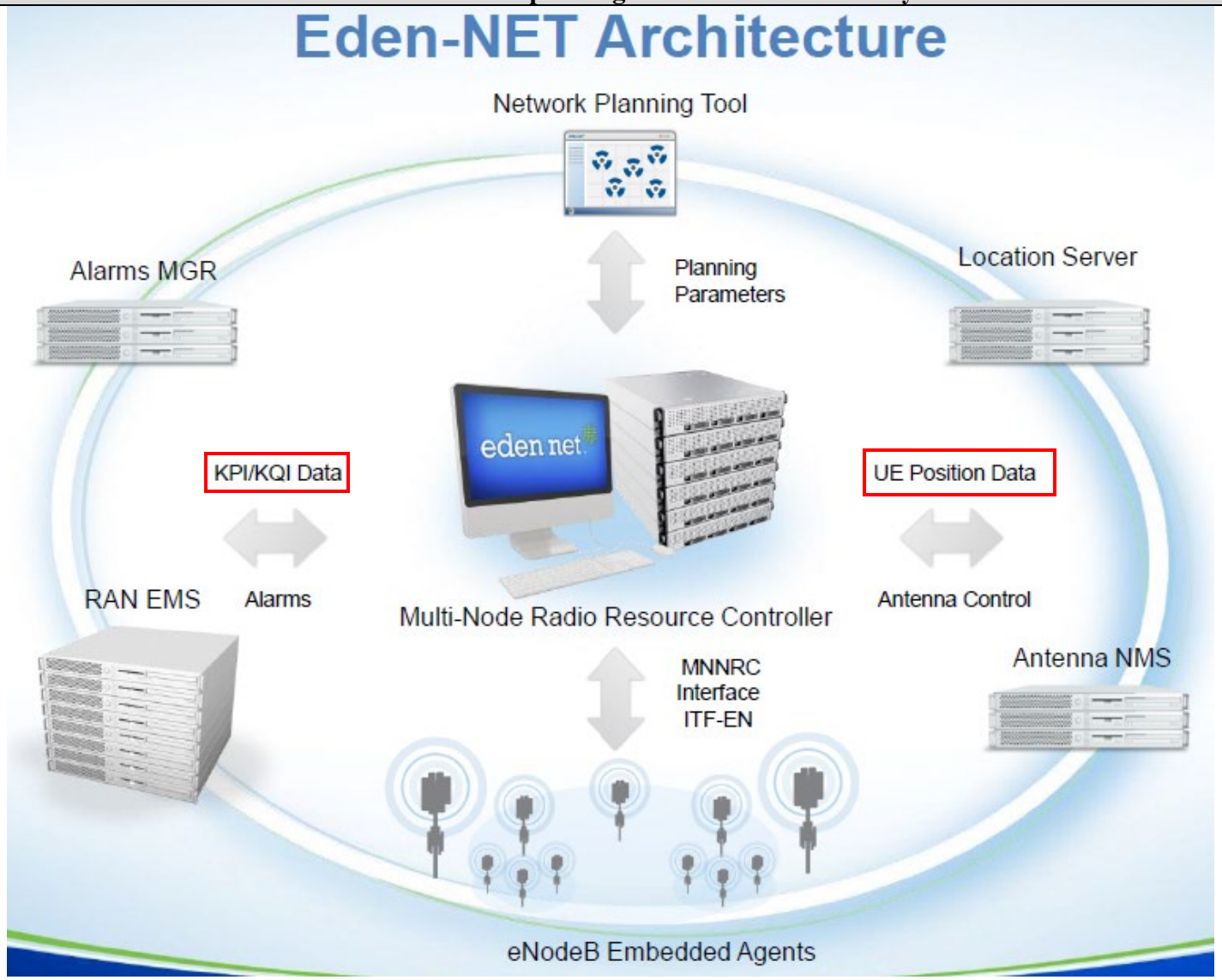
Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 10.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

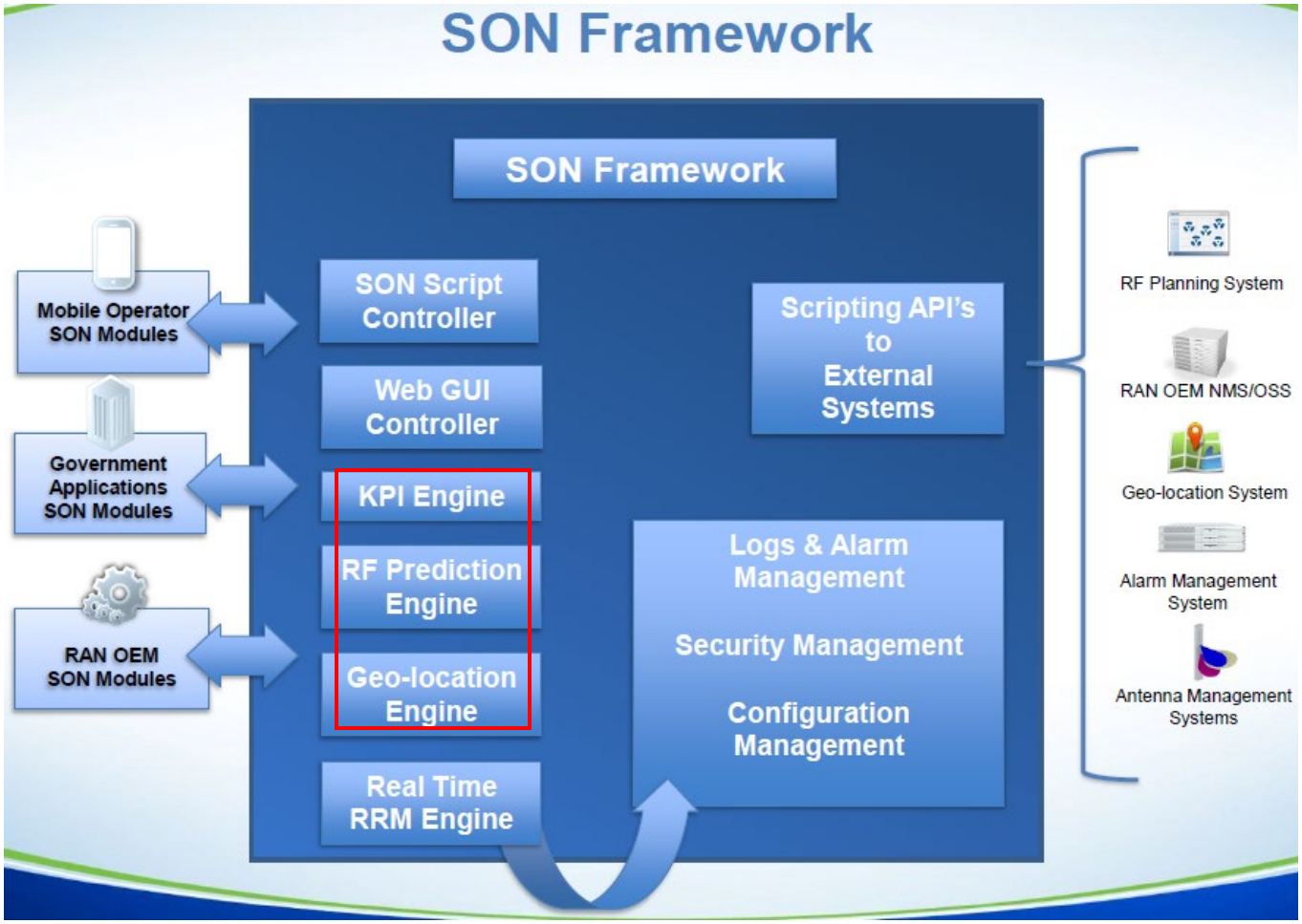
Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 24.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	 **Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 38.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

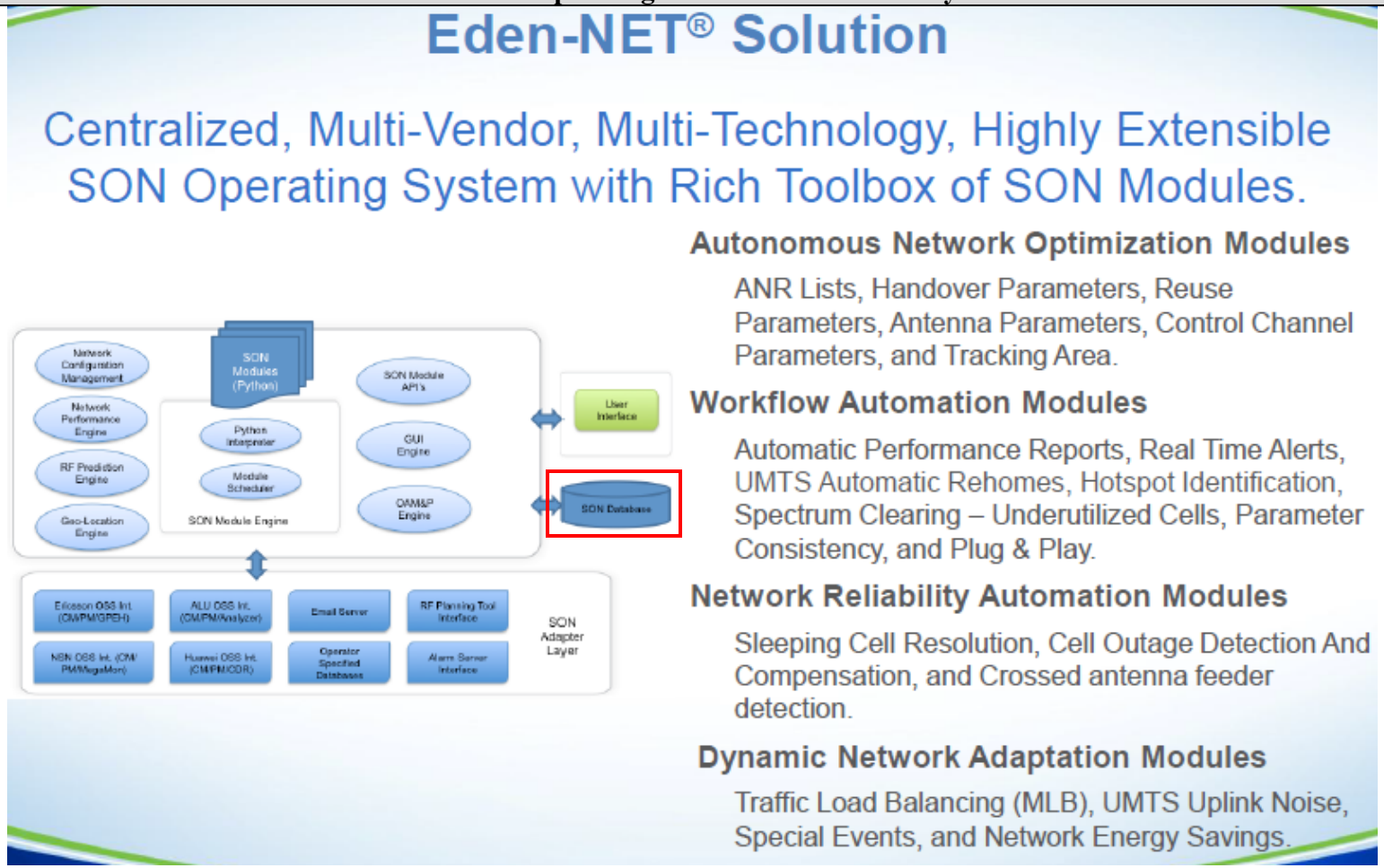
Claim 1	Corresponding Structure in Accused Systems



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 39.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

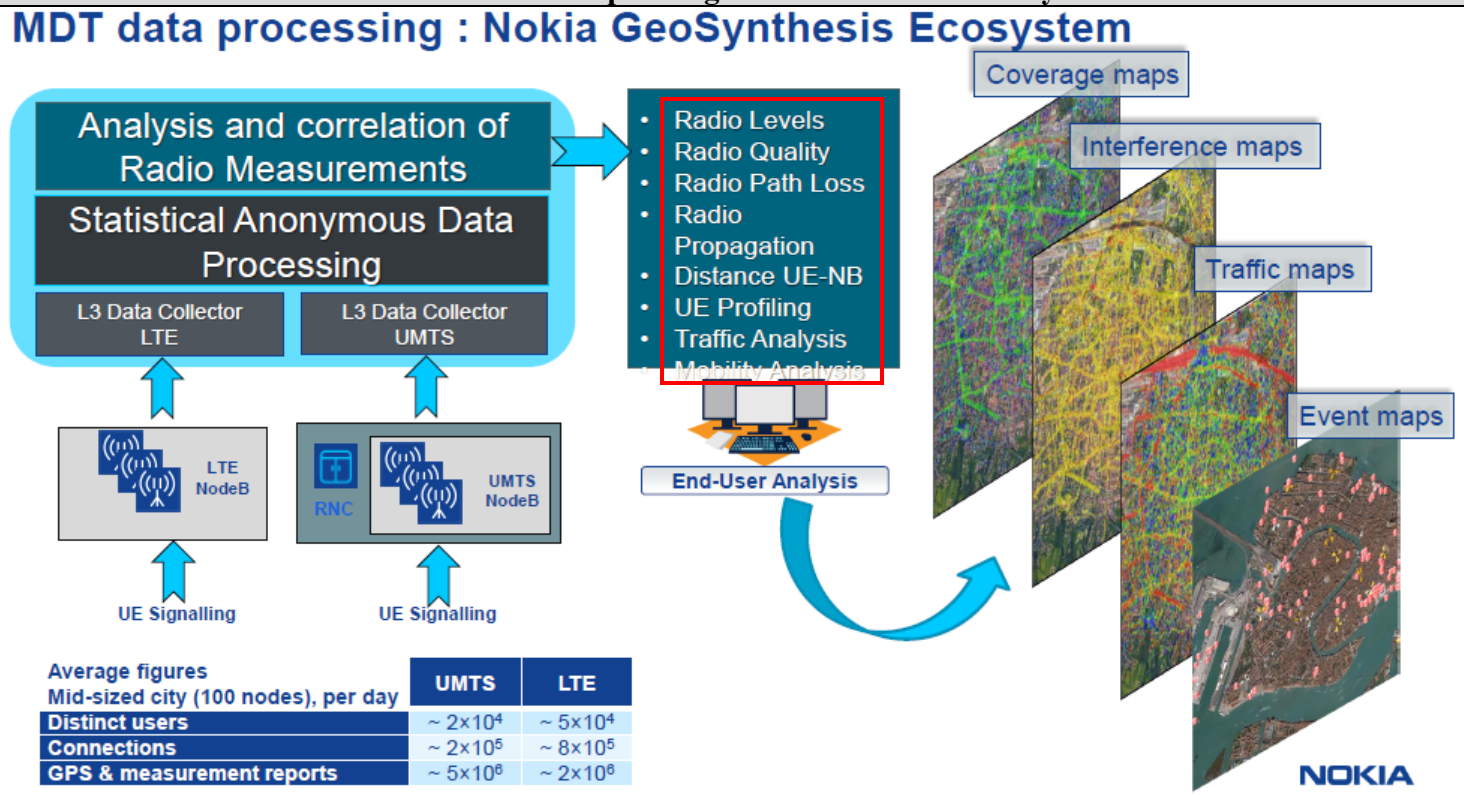
Claim 1	Corresponding Structure in Accused Systems



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 41.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

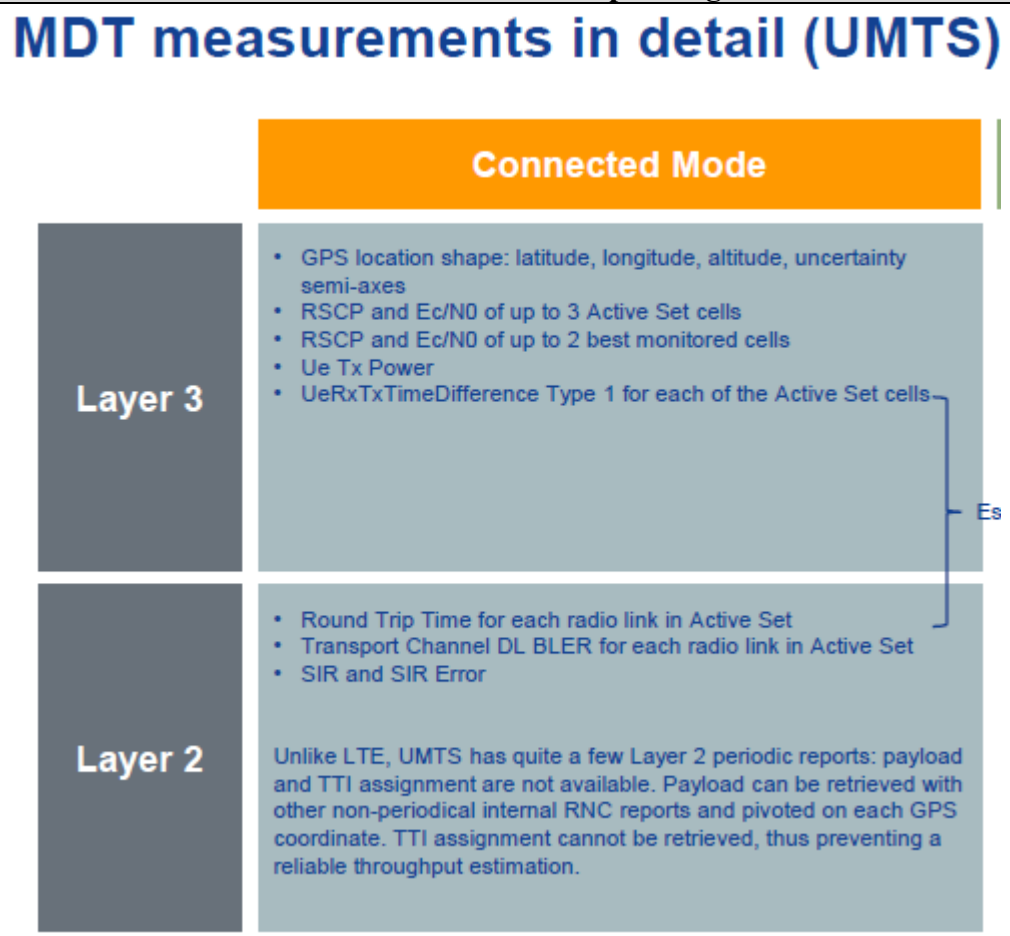
Claim 1	Corresponding Structure in Accused Systems



Average figures Mid-sized city (100 nodes), per day	UMTS	LTE
Distinct users	~ 2×10^4	~ 5×10^4
Connections	~ 2×10^5	~ 8×10^5
GPS & measurement reports	~ 5×10^6	~ 2×10^6

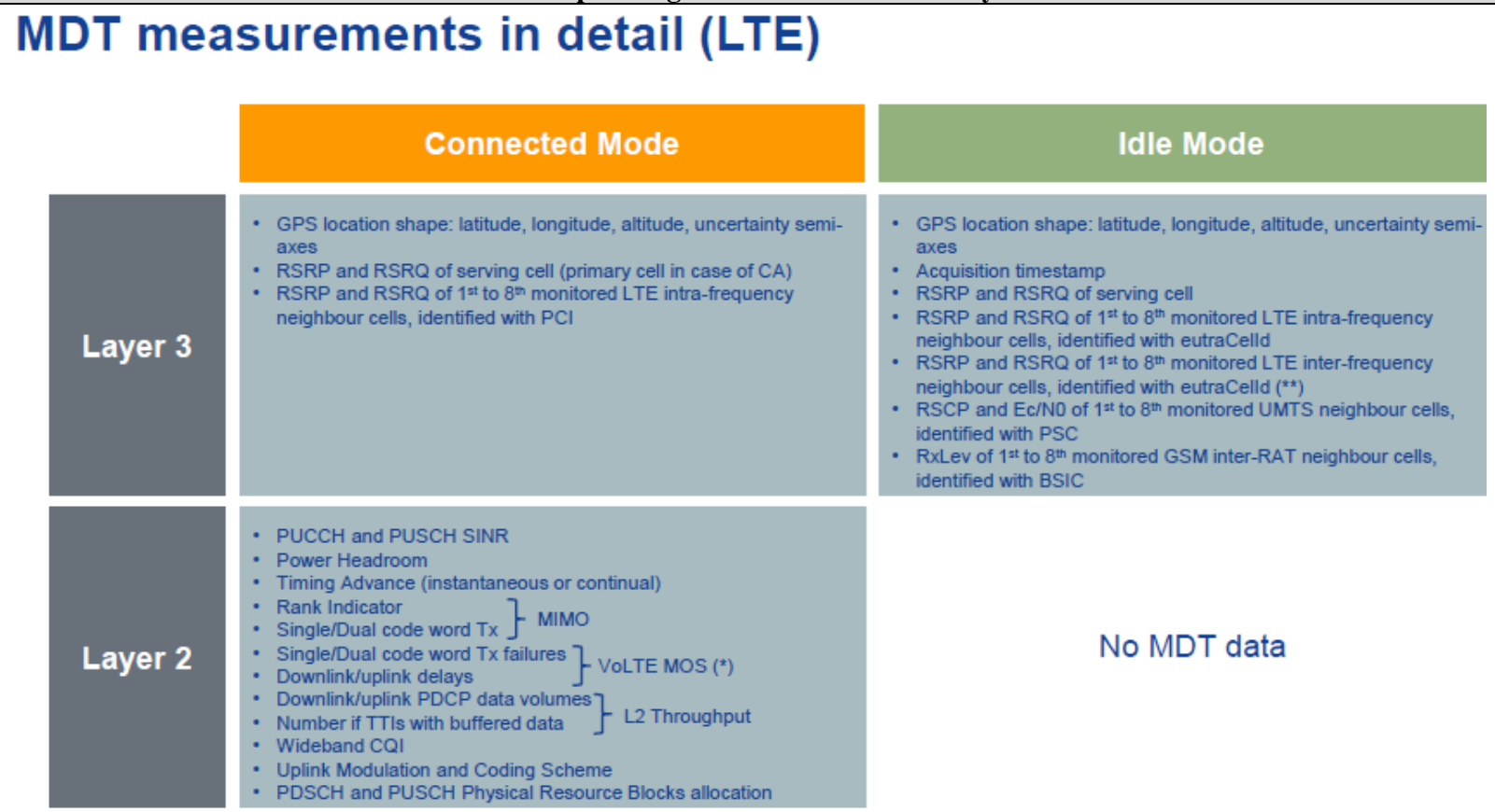
Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 7.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	 …

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

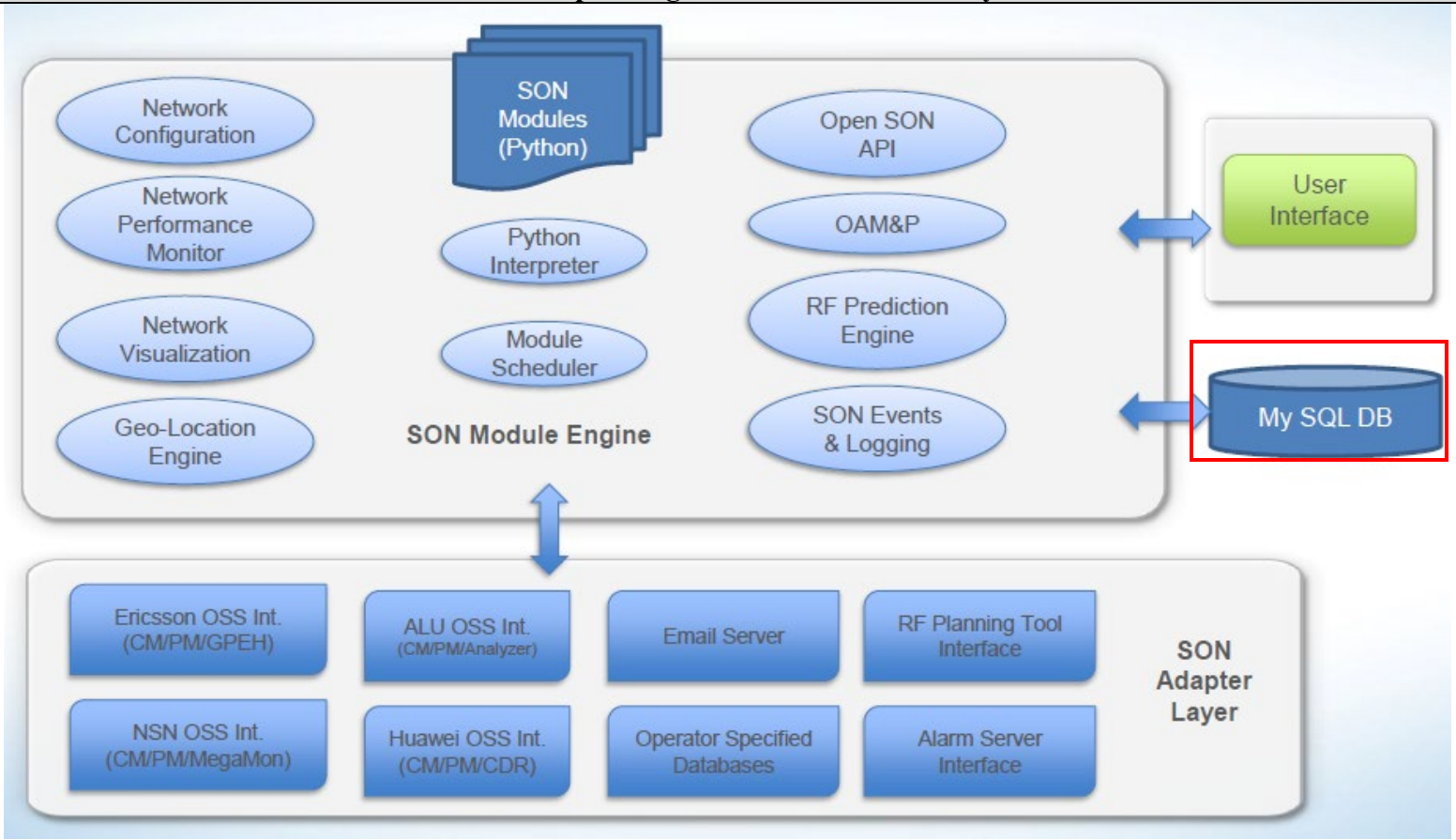
Claim 1	Corresponding Structure in Accused Systems



Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 9 and 10.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 42.

5.3 LTE1049: MDT - UE Measurement Logs

5.3.1 Description of LTE1049: MDT - UE Measurement Logs

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Introduction to the feature

The *LTE1049: MDT - UE Measurement Logs* feature allows the eNodeB to support the configuration and retrieval of user equipment (UE) measurement logs as well as to report those with a cell trace.

…

operators. A minimization of drive tests (MDT) has been proposed in order to meet operator requirements. It is a method of collecting the DT data directly from regular UEs used in the network; it is a less expensive approach to DTs. There are two modes of MDT measurements:

…

The UE measurement logs contain the following information:

- location info (global navigation satellite system (GNSS) information is optional for the UE)
- time stamp
- serving cell ID
- serving cell measurements
- neighbor cell measurements

Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 308 and 309.

3.4 LTE951: Enhanced Cell ID Location Service

3.4.1 Description of LTE951: Enhanced Cell ID Location Service

Introduction to the feature

The *LTE951: Enhanced Cell ID Location Service* feature improves location reporting by introducing enhanced cell ID reporting (E-CID) to the E-Serving Mobile Location Center (E-SMLC).

…

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	End-user benefits This feature: • enables determining UE position in case of emergency calls • enables using applications requesting UE positioning (for example maps, etc.) **Operator benefits** This feature allows the operator to turn the location services in a cell on and off. … Providing the operator's network contains a mobility management entity (MME) and E-SMLC provided by other vendors, it is assumed that these network elements support the LPPa messaging for E-CID before the *LTE951: Enhanced Cell ID Location Service* feature is deployed. It is also assumed that any timers on the MME and E-SMLC (that are preventing message response timeouts) can be adjusted as they are needed to ensure successful inter-operability with Nokiaan eNB. **Functional description** **Functional overview** The *LTE951: Enhanced Cell ID Location Service* feature introduces enhanced cell ID (E-CID) location services. The location service is performed in two steps: 1. The UE is positioned based on its serving cell's ID. 2. The UE is positioned more accurately inside a single cell, using one of the following four methods: • Timing advance type 1 • Timing advance type 2 • Intra-frequency Reference Signal Received Power (RSRP) and/or Reference Signal Received Quality (RSRQ) **Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 63 and 64.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

1. T-Mobile's Wireless Network Services and Customer Location Information

12. T-Mobile provides mobile voice and data services to consumers throughout the United States by enabling consumer mobile phones to make and receive calls or transmit data on T-Mobile's wireless network.[43] The mobile phones of T-Mobile subscribers, like those of customers of other carriers, periodically register with nearby network signal towers.[44] T-Mobile uses the information generated from this registration activity to ensure the proper functioning of its network and to provide the services to which its customers subscribe.[45] Because T-Mobile knows the location of its network signal towers, T-Mobile is able to calculate the approximate geographic location of the mobile phones communicating with its towers.[46] This type of location information—which is created even when the customer does not have an active established connection, such as a voice call or data usage—may at times be helpful to consumers. For example, in emergencies, the location of a customer's mobile phone can enable first responders and law enforcement to assist. Location information is also used for non-emergency location-based services, such as roadside assistance, delivery tracking, and fraud prevention.[47] Other widely used

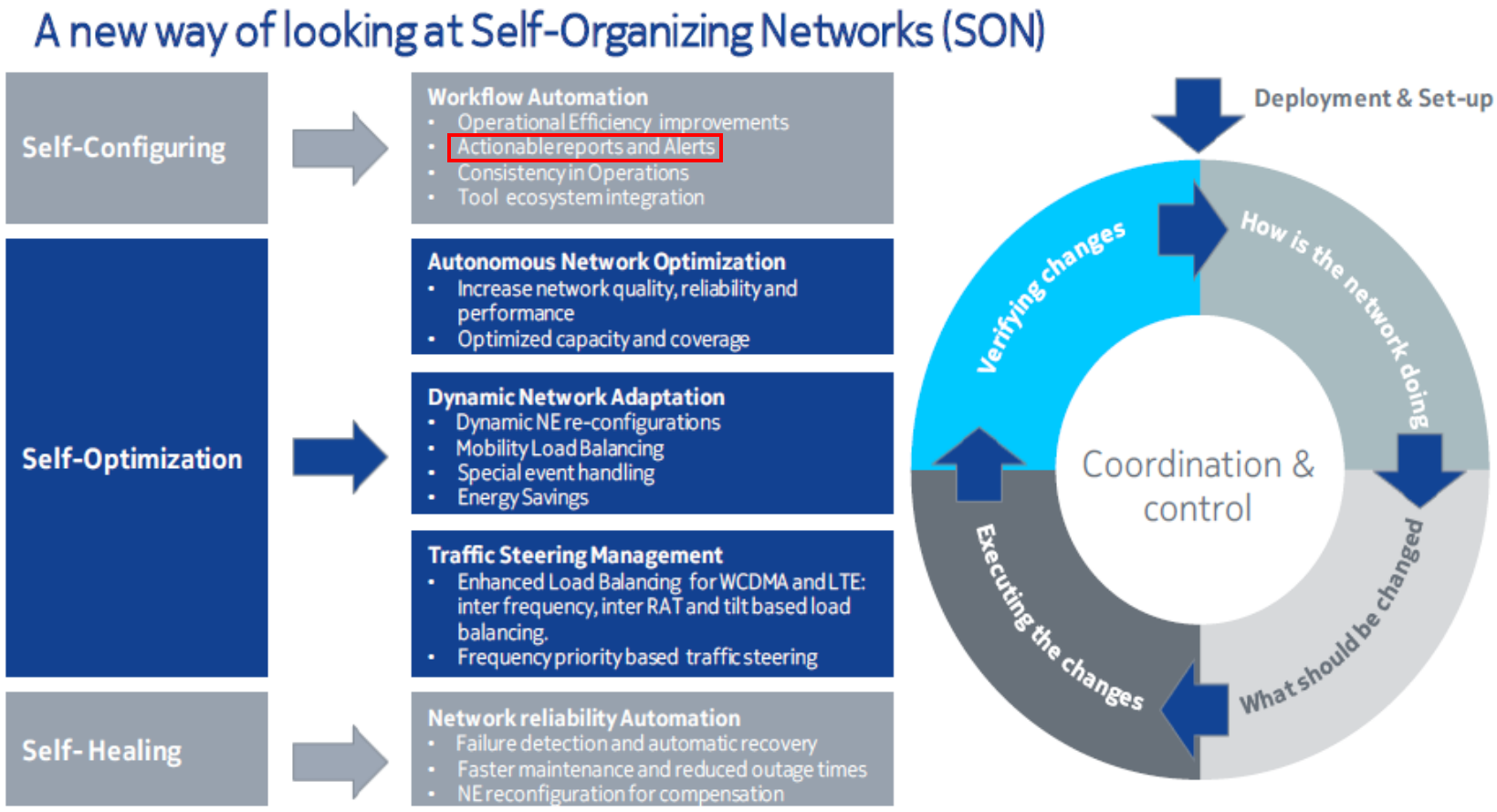
43. The customer location information at issue here meets these two criteria. *First*, it relates to the location of a telecommunications service, i.e., T-Mobile's commercial mobile service.[124] The location data was derived from the wireless mobile devices of T-Mobile's customers communicating with nearby network signal towers to signal the location of those devices. A wireless mobile device undergoes an authentication and attachment process to the carrier's network, via the closest towers. After a mobile device is authenticated and logically attached to a wireless network, it may be (1) connected (sending/receiving data/voice) or (2) idle. In either state, the carrier must be aware of and use the device's location in order for it to enable customers to send and receive calls. T-Mobile is therefore providing telecommunications service to these customers whenever it is enabling the customer's device to send and receive calls—regardless of whether the device is actively in use for a call. This view finds ample support in Commission precedent, including the *2013 CPNI Declaratory Ruling*, which indicates that the policy considerations remain the same throughout a consumer's use of a mobile device, including the entire process through which the device stands ready to make or receive a call.[125]

Attachment 18 (Federal Communications Commission (2020)) at 6, 15 & 16.

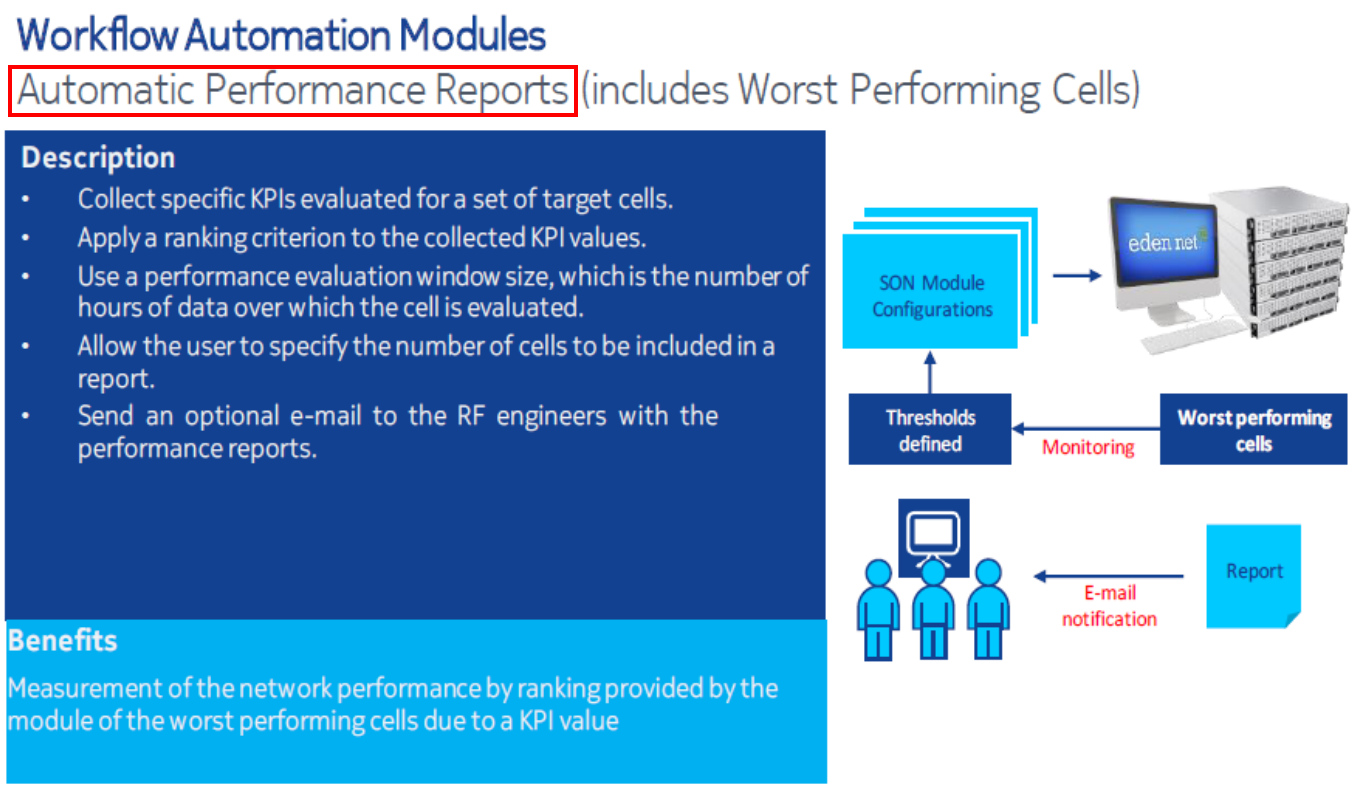
INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	Intra-frequency Reference Signal Received Power (RSRP) and/or Reference Signal Received Quality (RSRQ) These measurements are performed by a UE and reported to an eNB. When a request for the RSRP, or RSRQ, or both of them arrives at an eNB, the eNB initiates an intra-frequency measurement configuration at the UE with a reportStrongestCells purpose. The exact type of this measurement is set by the value of triggerQuantity. Subject to a desired measurement, its value is set either to RSRP (in case the RSRP or both measurements are requested), or RSRQ (in case only this measurement is needed). The UE sends a measurement report to the eNodeB, which in turn sends the RSRP and/or RSRQ measurements to the E-SMLC, which calculates the UE's position. **Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 66.** The LTE CCO continually assesses the impact of network changes based on network KPIs. It verifies that the implemented changes are having a positive impact on the network by monitoring specific KPIs. These KPIs are selected from the following areas: • LTE accessibility, retainability, traffic, IRAT volumes, physical resource block utilization and channel quality indicator distributions • WCDMA accessibility, retainability, traffic, IRAT leakage and handover volumes • GSM accessibility, retainability, traffic, and handover **Attachment 15 (LTE Coverage and Capacity Optimization Guide (2017)) at 8.**
wherein the system of computers, responsive to detecting communications errors between the at least one mobile	Plaintiff contends the system of computers, a portion of which is executing or loaded with Nokia Eden-Net solution, for example, by using management functions such as Performance Management (PM), Fault Management (FM), Configuration Management (CM), etc. is capable of detecting communications errors or faults between the at least one mobile wireless communications device and the at least one RF transceiver in the form of alerts or alarms or notifications. In response to detecting communications errors or faults, the system of computers generates case files or reports or logs that describe the communications errors, a corresponding one of the at least one RF transceiver, a location of the corresponding one of the at least one RF transceiver and parameters of communications between the at least one mobile wireless communications

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
wireless communications device and the at least one radio-frequency transceiver, generates case files that describe the communications errors, a corresponding one of the at least one radio-frequency transceiver, a location of the corresponding one of the at least one radio-frequency transceiver and parameters of communications between the at least one mobile wireless communications device over a time interval prior to a corresponding one of the communications errors and extending to the	device over a time period before a corresponding one of the communications errors and extending to the time of the corresponding communications error. The following exemplifies this limitation's existence in Accused Systems:  **Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 6.** 

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
time of the corresponding communications error,	• Automatic Performance Reports (includes Worst Performing Cells) • Real Time Alerts • Parameter Consistency Enforcement • Automated Site Creation **Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 48.**  **Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 50.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	Workflow Automation Modules Real Time Alerts **Overview:** • This module allows the users to evaluate specific KPIs for a set of target cells based on a set of predefined thresholds. • The module will monitor the KPIs in the network against the pre-defined threshold, prepare report and notify the user via email about worst performing area. … When a SON module is configured in Eden-NET, thresholds also need to be defined. The module that is in charge of watching the thresholds is called 'Real-Time Alerts'. The Real-Time Alerts module monitors all the KPIs in the GSM, WCDMA, and LTE networks against the thresholds definitions. When any KPI breaches its threshold, this module generates a report and notifies the user via email about the worst performing areas. **Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 51.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

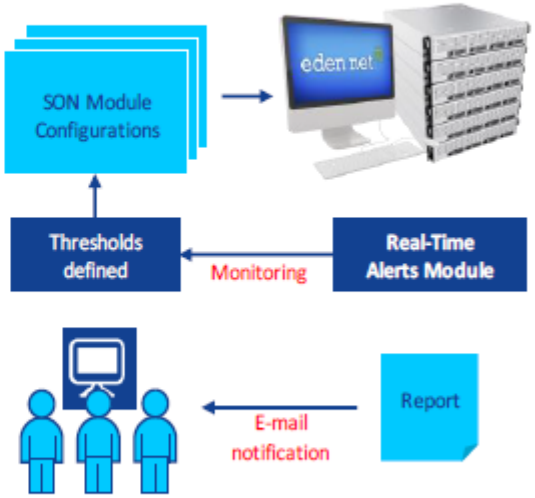
Claim 1	Corresponding Structure in Accused Systems

Workflow Automation Modules

Real Time Alerts

Description

- Monitor the KPIs in the network against the pre-defined threshold and prepares a report.
- Supports 2G, 3G and LTE KPIs
- Daily email report is sent to the RF engineers.



Benefits

Immediate indications to operators when the monitored KPIs cross defined thresholds. A powerful tool to monitor the performance of the network in real.

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 52.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Real-Time Alerts

Nokia Eden-NET

Network challenge

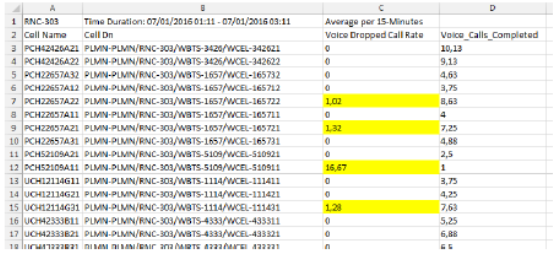
- How to find the degrading performance in the network

Solution

- Eden-NET monitors in real-time a more limited set of KPIs than the Automatic Performance Reports module
- Generates alarms and sends an email to the responsible RF engineer if the KPIs exceed pre-defined or learned thresholds.

Value driver

- Reduced response times to network issues, improved network reliability and a reduction in dropped calls, access failures



	A	B	C	D
1	RNC-303	Time Duration: 07/01/2016 01:11 - 07/01/2016 03:11	Average per 15-Minutes	
2	Cell Name	Cell Dn	Voice Dropped Call Rate	Voice_Calls_Completed
3	PCH42426A21	PLMN-PLMN/RNC-303/WBTS-3426/WCEL-342621	0	10,13
4	PCH42426A22	PLMN-PLMN/RNC-303/WBTS-3426/WCEL-342622	0	9,13
5	PCH22657A32	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165732	0	4,63
6	PCH22657A12	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165712	0	3,75
7	PCH22657A22	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165722	1,02	8,63
8	PCH22657A11	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165711	0	4
9	PCH22657A21	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165721	1,32	7,25
10	PCH22657A31	PLMN-PLMN/RNC-303/WBTS-1657/WCEL-165731	0	4,88
11	PCH52109A21	PLMN-PLMN/RNC-303/WBTS-5109/WCEL-510921	0	2,5
12	PCH52105A11	PLMN-PLMN/RNC-303/WBTS-5109/WCEL-510511	16,67	1
13	UCH12114G11	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111411	0	3,75
14	UCH12114G21	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111421	0	4,25
15	UCH12114G31	PLMN-PLMN/RNC-303/WBTS-1114/WCEL-111431	1,28	7,63
16	UCH42333B11	PLMN-PLMN/RNC-303/WBTS-4333/WCEL-433311	0	5,25
17	UCH42333B21	PLMN-PLMN/RNC-303/WBTS-4333/WCEL-433321	0	6,88

Automatic Performance Reports

Nokia Eden-NET

Network challenge

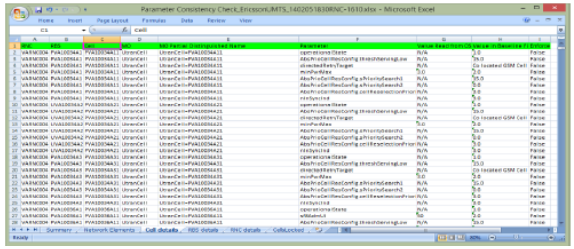
- How to find the worst performing cells in the network

Solution

- Eden-NET processes and analyzes continuously large volumes of performance data across each of the 2G, 3G, and 4G cell e.g.
  - Accessibility KPIs
  - Retainability KPI's
  - Throughput KPI's.
- Identifies the poorest performing cells
- Sends reports to RF Engineers

Value driver

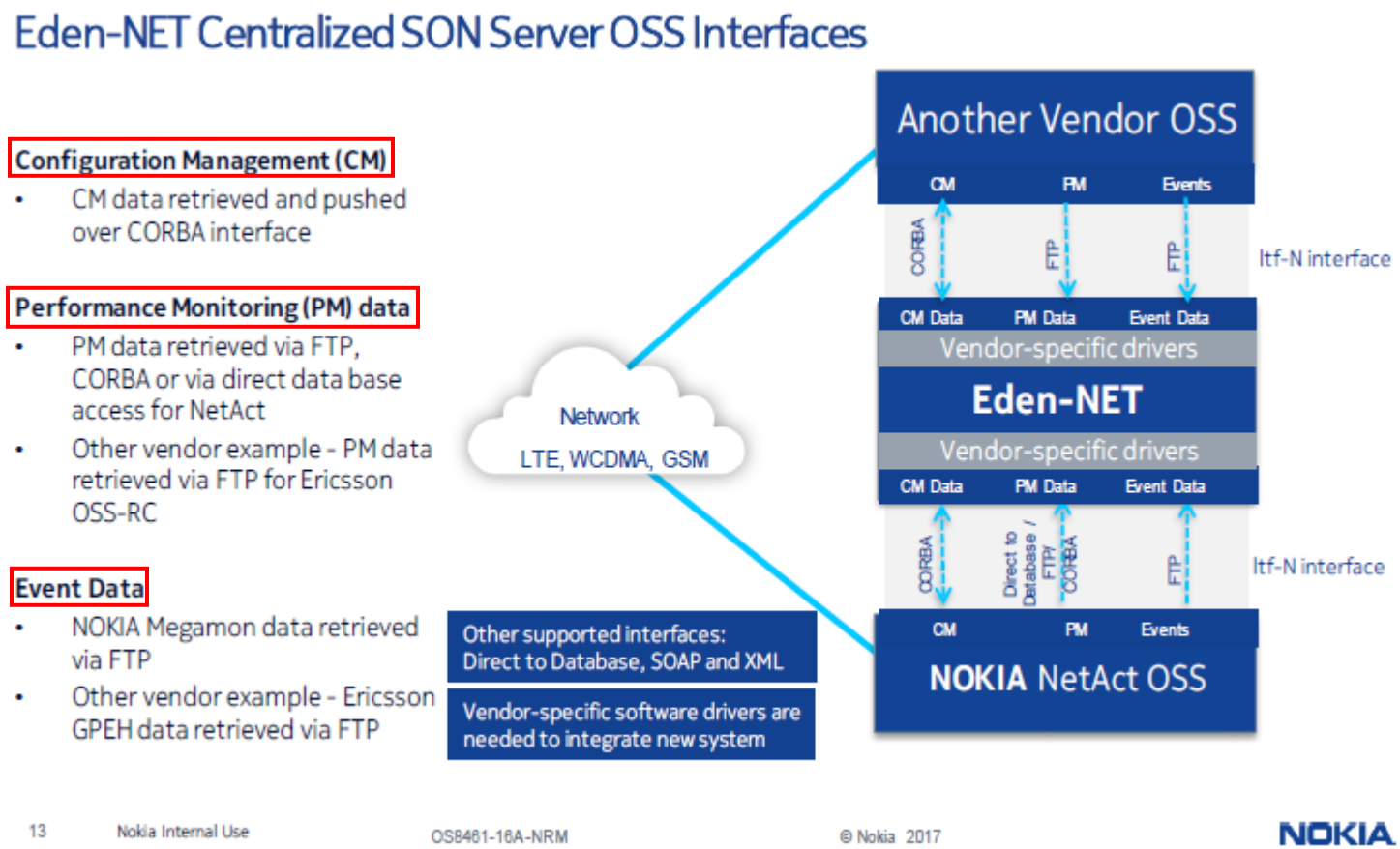
- Reduction in manual operational efforts in finding the poor performing network resources



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 25.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

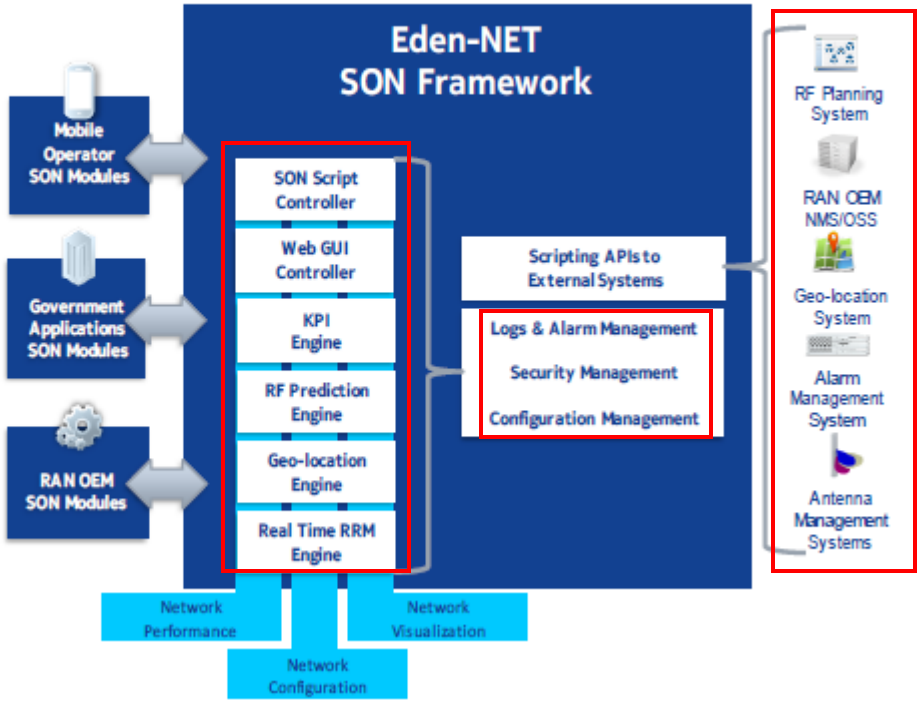


Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 12.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

SON Framework



…

The SON Framework serves the function of operating system for SON that makes easy to the Operators to manage and enable the individual SON modules. The SON Framework interacts with external systems such as OSS/NMS systems, antenna management systems, RF Planning systems, and Alarm Management systems. The scripting framework includes software API's to interface with these external systems.

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 11.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

NGMN Ref #	Use Case
Planning Related Use Cases	
[P01]	Base Station Location Planning
[P02]	Base Station Hardware Planning
[P03]	Automatic Generation of Radio Parameters
[P04]	Planning of transport parameters of a new Base Station
[P05]	Planning of security Node, Access GW and Operations and Maintenance Center
Deployment Use Cases	
[D01]	Hardware Installation
[D02]	Network authentication
[D03]	Software Installation
[D04]	Transport Parameter Setup
[D05]	Radio Parameter Setup
[D06]	Testing (Built in Diagnostic/Self Tests)
Optimization Use Cases	
[O01]	Radio Parameter Optimization: Neighbor cell list optimization
[O02]	Radio Parameter Optimization: Interference Control
[O03]	Radio Parameter Optimization: HO parameterization optimization
[O04]	Radio Parameter Optimization: QoS related parameter optimization
[O05]	Radio Parameter Optimization: Optimization Scenarios with Home BS/Pico BS
[O06]	Transport Parameter Optimization: Routing Optimization
[O07]	Transport Parameter Optimization: Optimization Scenarios with Home BS/Pico BS
[O08]	Reduction of Energy Consumption
[ERO01]	Capacity Optimization (Congestion Prime)
Maintenance Use Cases	
[Ops01]	Hardware / Capacity extension (Easy plug and play hardware replacement)
[Ops02]	Autonomous Inventory
[Ops03]	Automatic SW Download to Base Station
[Ops04]	Automated NEM upgrade
[Ops05]	Cell outage detection
[Ops06]	Performance Management in real time
[Ops07]	Direct KPI reporting in real time
[Ops08]	Information Correlation for Fault Management
[Ops09]	Subscriber and Equipment trace
[Ops10]	Cell Outage Compensation
[Ops11]	Compensation for Outage of higher level network elements (ASN GW)
[Ops12]	Fast recovery on instable NEM system
[Ops13]	Mitigation of outage of units
[EROps01]	System Availability

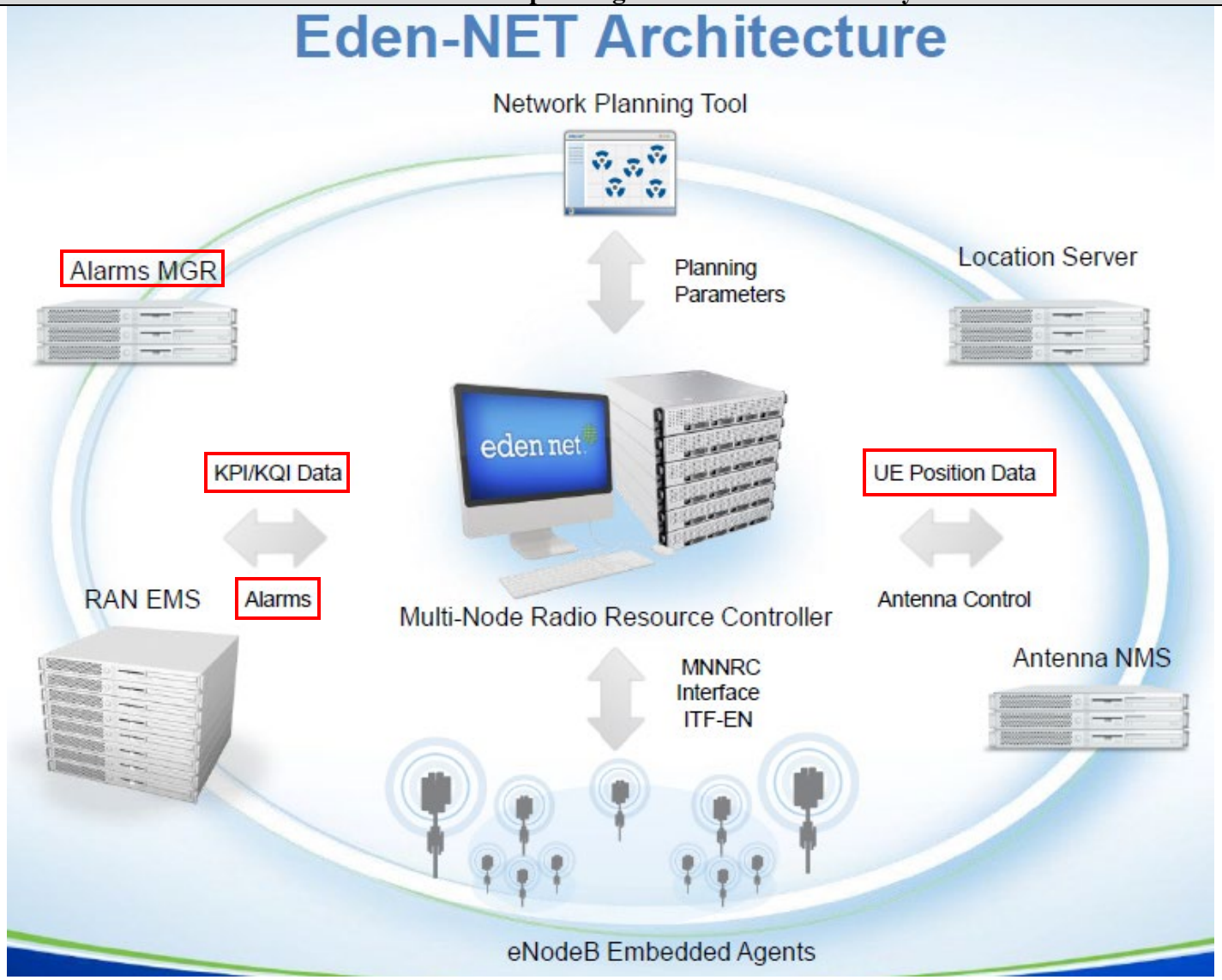
Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 10.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 24.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	 **Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 38.**

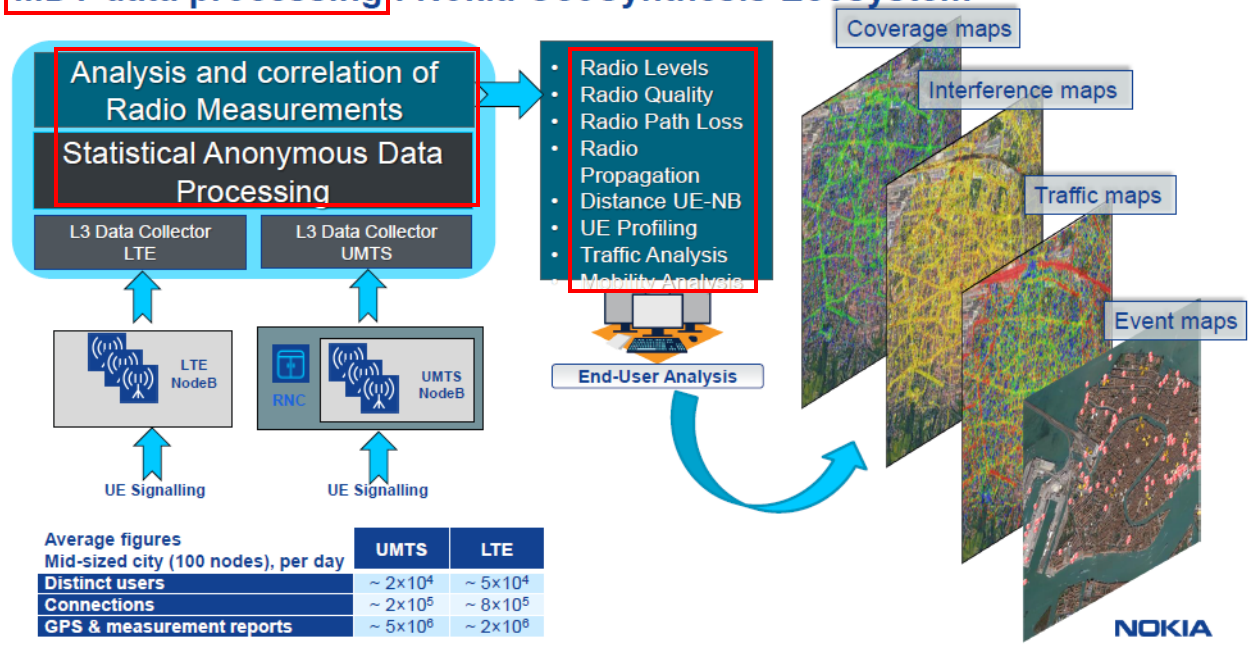
INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	5.3 LTE1049: MDT - UE Measurement Logs **5.3.1 Description of LTE1049: MDT - UE Measurement Logs** **Introduction to the feature** The *LTE1049: MDT - UE Measurement Logs* feature allows the eNodeB to support the configuration and retrieval of user equipment (UE) measurement logs as well as to report those with a cell trace. … operators. A minimization of drive tests (MDT) has been proposed in order to meet operator requirements. It is a method of collecting the DT data directly from regular UEs used in the network; it is a less expensive approach to DTs. There are two modes of MDT measurements: … The UE measurement logs contain the following information: • location info (global navigation satellite system (GNSS) information is optional for the UE) • time stamp • serving cell ID • serving cell measurements • neighbor cell measurements **Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 308 and 309.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

MDT data processing: Nokia GeoSynthesis Ecosystem



Average figures Mid-sized city (100 nodes), per day	UMTS	LTE
Distinct users	~ 2×10^4	~ 5×10^4
Connections	~ 2×10^5	~ 8×10^5
GPS & measurement reports	~ 5×10^6	~ 2×10^6

Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 7.

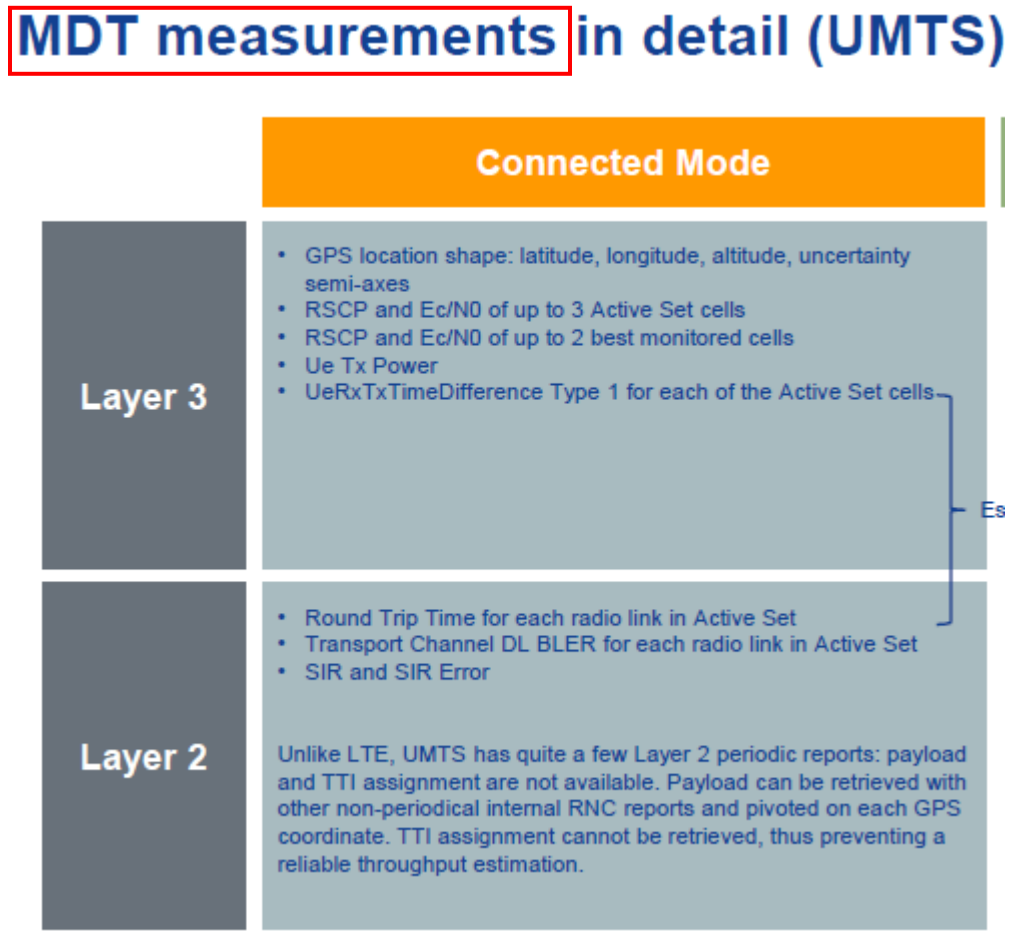
The LTE CCO continually assesses the impact of network changes based on network KPIs. It verifies that the implemented changes are having a positive impact on the network by monitoring specific KPIs. These KPIs are selected from the following areas:

- LTE accessibility, retainability, traffic, IRAT volumes, physical resource block utilization and channel quality indicator distributions
- WCDMA accessibility, retainability, traffic, IRAT leakage and handover volumes
- GSM accessibility, retainability, traffic, and handover

If the module detects that KPIs are degrading after a parameter change has been applied, then the module rolls back the parameters to their previous settings and blacklists the cells.

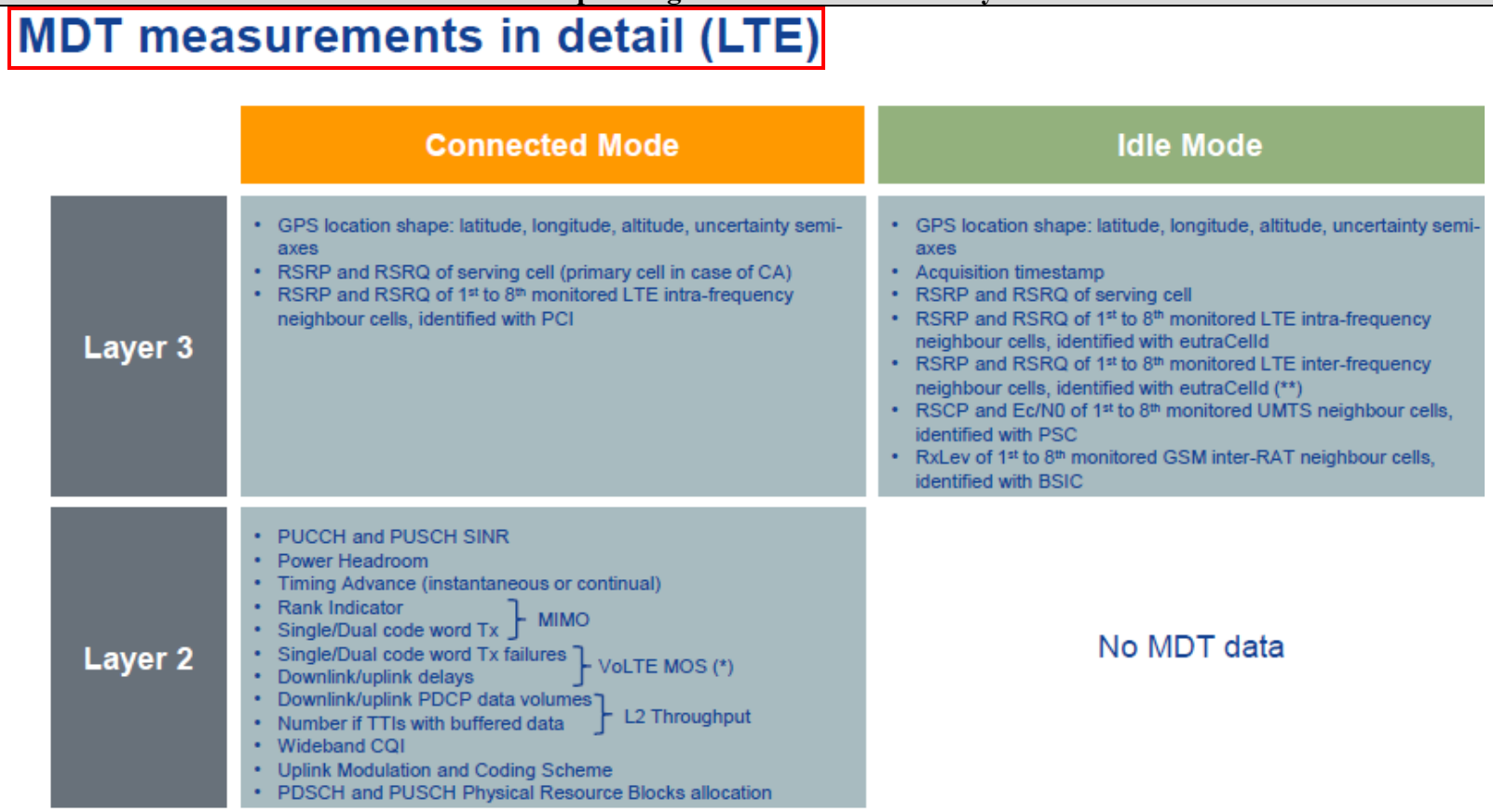
Attachment 15 (LTE Coverage and Capacity Optimization Guide (2017)) at 8.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	 …

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 9 and 10.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Eden-NET® SON Modules

Deployed at Scale and Delivering the Industry's Best Results.

SON Module	2G	3G	4G
Automatic Performance Reports	↑	↑	↑
Real-Time Alerts	↑	↑	↑
Parameter Consistency Enforcement (PCE)	↑	↑	↑
Automatic Neighbor Relation (ANR)	↑	↑	↑
Layer Management Strategy (LMS)	↑	↑	↑
Reuse Code Optimization (RCO)	Q3	↑	↑
Coverage & Capacity Optimization (CCO)	N/A	↑	↑
Mobility Load Balancing (MLB)	N/A	↑	↑
Crossed Antenna Detection	↑	↑	↑
Plug & Play	N/A	↑	↑
Mobility Robustness Optimization (MRO)	N/A	Q1 '16	Q3
Sleeping Cell	N/A	↑	Q3
Automatic Parameter Optimization (APO)	Q4	Q4	Q4
Cell Outage Compensation	N/A	Q4	Q3
Special Event	Q4	Q4	Q4

SON Module	2G	3G	4G
Hotspot Identification	N/A	Q1 '16	Q1 '16
Enhanced Mobility Load Balancing (MLB)	N/A	Q1 '16	Q1 '16
Green Networks	Q1 '16	Q1 '16	Q1 '16
RACH Parameter Optimization	N/A	'16	Q4
Enhanced Plug & Play	N/A	N/A	Q1 '16
Spectrum Clearing	'16	N/A	N/A
Carrier Aggregation Optimization	N/A	N/A	'16
VoLTE Optimization	N/A	N/A	'16
Data Correlation	N/A	'16	'16
Tracking Area Optimization	N/A	N/A	'16
eICIC Optimization	N/A	N/A	'16
MIMO Optimization	N/A	N/A	'16
Uplink Noise Optimization	N/A	'16	N/A
CoMP Reporting	N/A	N/A	'16

NOKIA

Attachment 11 (Eden-Net with iSON Manager (2015)) at 7.

Information We Collect Automatically

We automatically collect a variety of information associated with your use of your device (on our network, when roaming, or in WiFi mode) and our products and services, some of which may be associated with you or another user on your account.

…

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

For example some of the ways we may automatically collect information include:

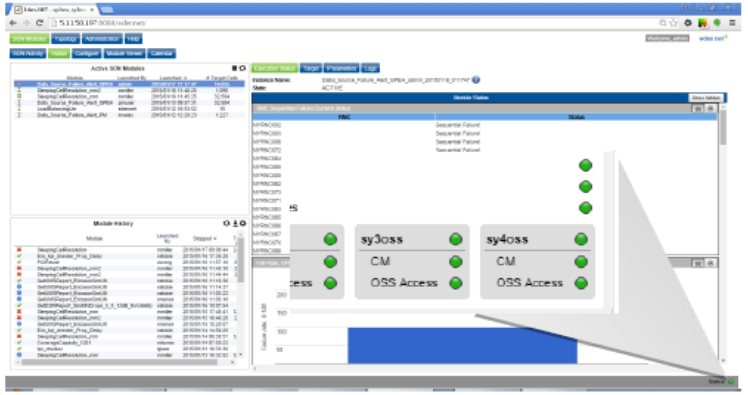
- Our systems capture details about the type and location of wireless device(s) you use, when the device is turned on, calls and text messages you send and receive (but we do not retain the content of those calls or messages after delivery), and other data services you use.
- We may also gather information about the performance of your device and our network. Some examples of the types of data collected include: the applications on the device, signal strength, dropped calls, data failures, and other device or network performance issues.

Attachment 1 (T-Mobile Privacy Statement Highlights (Webpage, 2016)) at 6.

Nokia Eden-NET

- IT System Integrations.

IT System	Availability
PM	↑
CM	↑
Call Trace	↑
Subscriber Geolocation	Q4 '15
FM	Q3 '15
Big Data Systems	'16
Trouble Ticket and Work Order Systems	'16
Inventory management systems	'16
MME OSS: PM, CM Integration	'16
CEM	'16
Drive Test and 3rd Party Probe	'17



The SON Adapter Layer provides a well-structured extensible abstraction layer for interfacing with external systems.

Attachment 11 (Eden-Net with iSON Manager (2015)) at 9.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Eden-NET provides users the capability to visualize geographic relationships between targeted network cells. These visualizations and targets are managed via Eden-NET's extensive visualization screens, which support multiple radio access technologies and allow users to quickly receive feedback regarding SON actions applied to network elements.

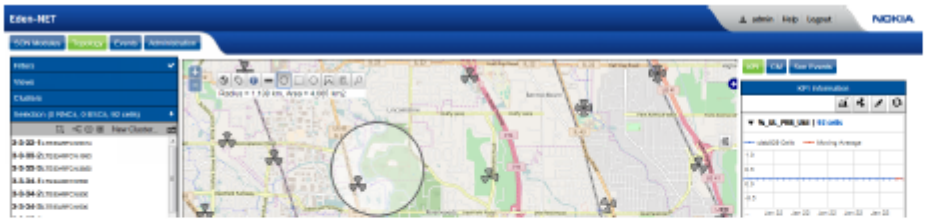
The contents of this guide develop one's understanding of the functionality and features found throughout Eden-NET and introduce key areas of understanding, including:

- Management of user accounts
- Interacting with network topology maps and network elements
- Configuring and monitoring SON Modules for execution
- Retrieving output files and log reports
- Understanding SON history and status screens
- Defining topology
- Tracking network performance with KPI charts
- Using administrative functions such as Rollback, importing modules, exclusion or inclusion of lists, and configuring account privileges
- Using different map controls
- Managing KPI charts
- Viewing SON events
- Using Automated Site Creation functionality

Attachment 12 (Eden-NET User Guide (2017)) at 7.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Map scale and Lat/Long

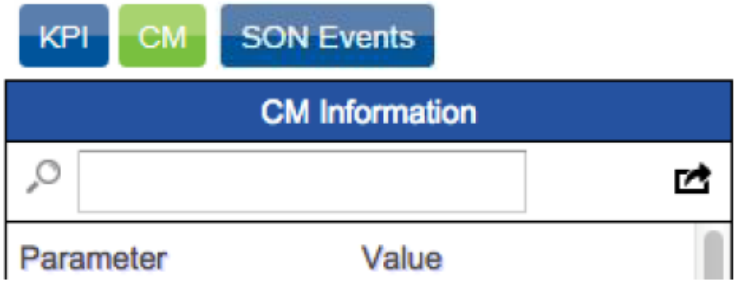
The map's reference scale and geographical Lat/Long coordinates are located on the bottom left and bottom right of the map, respectively.

6.10.3 Cell Information

Eden-NET provides multiple ways to view cell and network information. These include:

CM Information

The CM Information window is found under the same set of tabs as the KPI Information window under **Topology**.



This window provides configuration information for network elements. Select a cell to view its CM information. Cell selection for this purpose can be achieved using the map, the Selection list, or the CM Information text box search tool. The icon allows for the CM Information to either be opened in a new window or exported to CSV.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Cell Labels

The tag icon , located in the map toolbar, activates cell ID labels.

Cell Information Window

The information icon , located in the map toolbar, opens the Cell Information Window when activated. This information window is located in the bottom left corner of the map. To view a cell's information in this window, hover over the cell on the map. Information provided in this window includes:

- Cell ID
- Technology (2G, 3G, 4G – Frequency)
- Scrambling Code/PCI Code
- CGI (Cell Global ID)
- Member of RNC/BSC

Attachment 12 (Eden-NET User Guide (2017)) at 69 and 70.

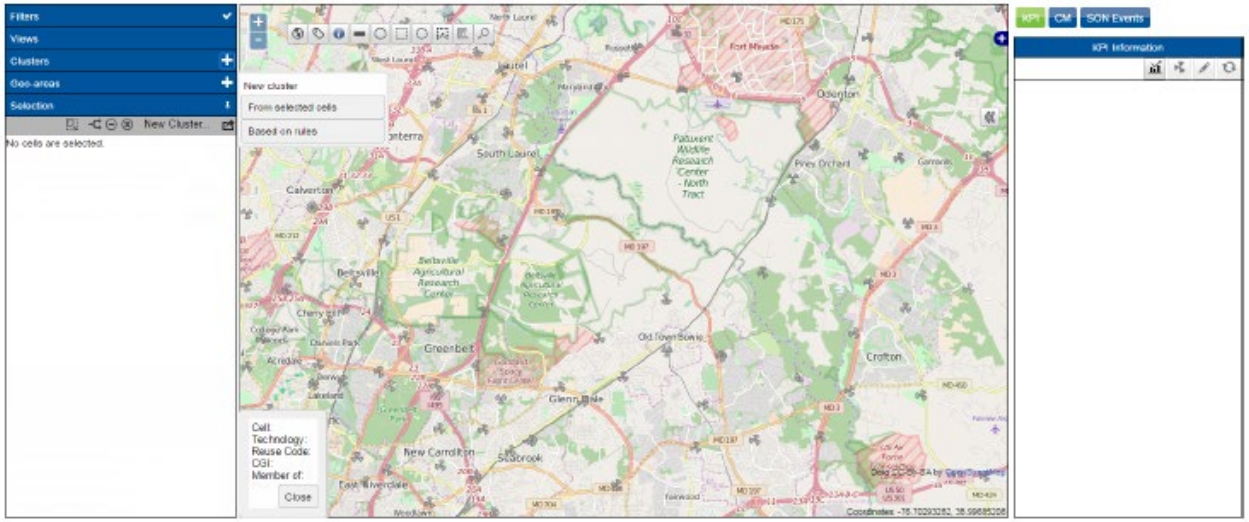
INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

6.5 Select Cells

This section provides methods for making cell selections in Eden-NET.

In order to configure and execute **SON Modules** in Eden-NET, cells must first be selected and added to the **Selection** list which displays the number of RNCs/BSCs selected and the number of cells selected, as highlighted below.



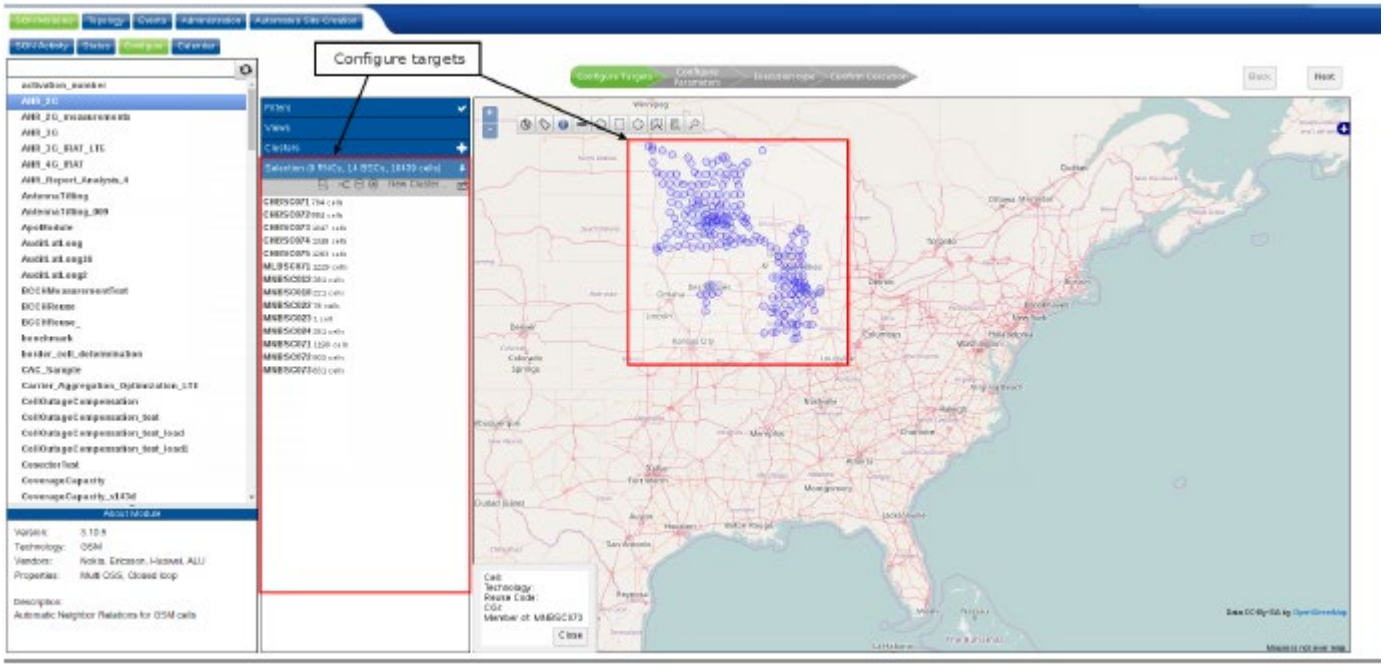
Attachment 12 (Eden-NET User Guide (2017)) at 53 and 54.

5.3.1 Configuring targets

Select targets for configuration by using one of Eden-NET's methods for selection of cells. Methods include using map-based or cell name search selection tools from the map toolbar, using existing clusters that have been created, and using Eden-NET's capability for vendor and/or controller (RNC/BSC) selection. When the SON Module and the target cells are selected, click **Next**.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 12 (Eden-NET User Guide (2017)) at 28.

5.1.3 Creating SON Module KPI chart

This screen displays the KPI chart for module level KPIs. These charts display the SON KPI information aggregated for all instances of the same module type, for example, a SON KPI chart for ANR MO additions shows MO additions for all module instances of ANR.

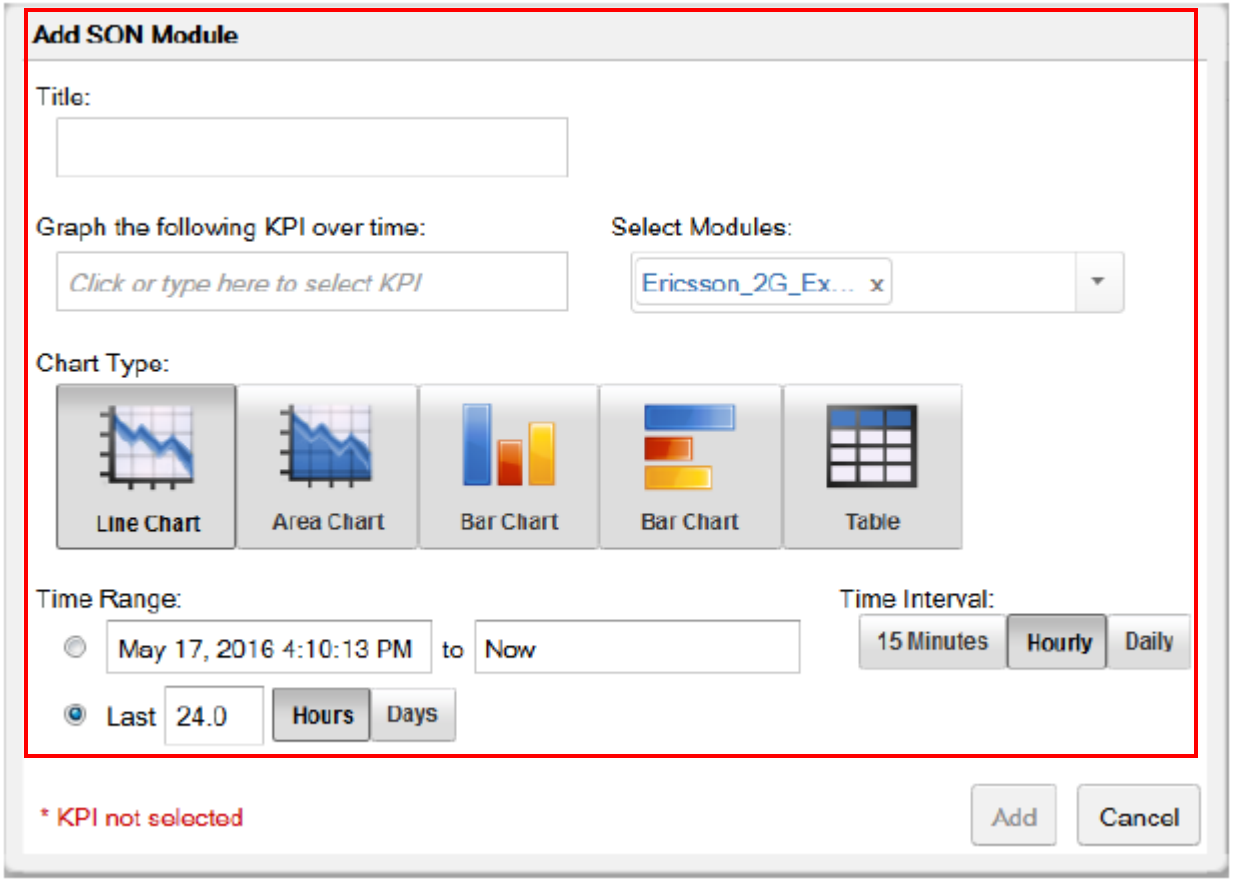
…

4. In **SON KPI Charts** tab, click the **Chart**  icon.

The **Add SON Module** dialog box appears.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



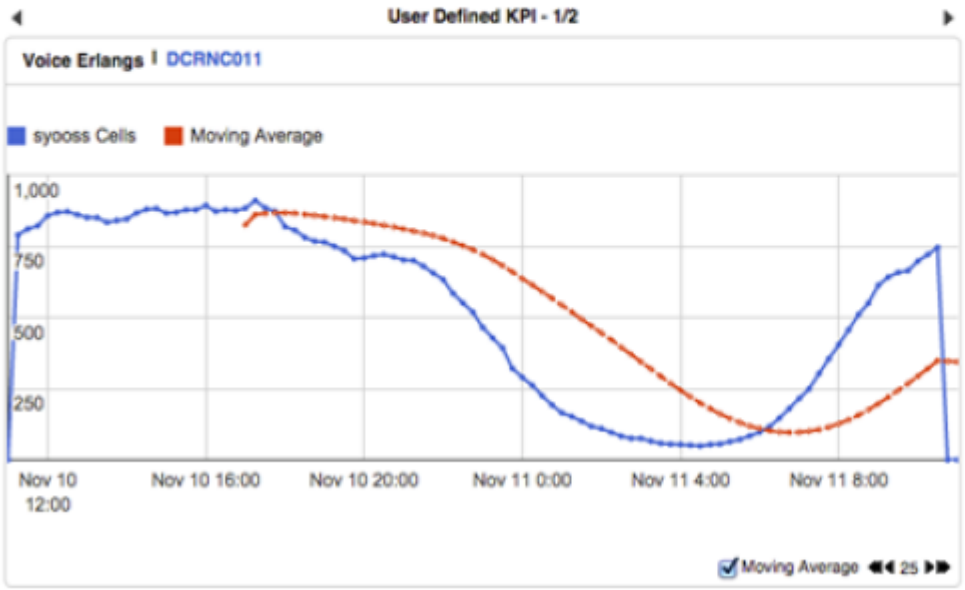
Attachment 12 (Eden-NET User Guide (2017)) at 16 and 17.

5.1.4 Viewing user defined KPI charts

The User Defined KPI window of the **SON Activity** screen houses charts that graphically represent various Key Performance Indicators. To view charts:

…

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	User Defined KPI charts are visible below the **SON Module Activity** area. These charts are user-defined and are configured under the **Topology** tab. Once created, KPI charts can be sent to the home screen for easier accessibility of information.  **Attachment 12 (Eden-NET User Guide (2017)) at 18.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

6.2.2 KPI View

The KPI View provides the capability to visually represent cells on the map based on their performance record. For example, a user can configure this view to display cells with a high number of dropped calls as red and cells with a low number as green.

- KPI for configuration
- Date of data (default is Most Recent)
- Resolution (default is Hourly)
- Define the thresholds for the KPIs.

Attachment 12 (Eden-NET User Guide (2017)) at 36.

Nokia Eden-NET offering on Day-1 to key customers - RPCI Highlights

- Ultimate release of Eden-NET enables, true multi-vendor solutions:
  - **Richer set of Autonomous network automation modules:**
    - Industry leading 2G/3G/4G ANR optimization (AAO)
    - Comprehensive CCO module covering 3G and 4G
    - Reuse code Optimization for 3G-SC, 4G-PCI/RSI
  - **Enhanced Dynamic Network Adaptation and Workflow automation:**
    - Crossed Antenna Detection for 2G/3G/4G
    - Automatic Parameter Consistency Enforcement(Auditing) for 2G/3G/4G
    - Competitive Mobility Load Balancing (Intra-frequency)
    - MORAN support through layer management strategies
  - **Network Reliability Automation:**
    - KPI based sleeping cell detection/resolution for 2G/3G/4G
- System self-monitoring with alarms and alerts (Email, SMS)
- Consistent support for Nokia, Ericsson and Huawei

Confidential 11/13/15

eden rock communications NOKIA

Attachment 11 (Eden-Net with iSON Manager (2015)) at 11.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Nokia Eden-NET grows stronger during Q3-Q4, 2015 - RPCI Highlights

- [illegible] LTE RAN integration
- LTE MRO
- Cell Outage Compensation (COC) – KPI based
- Reuse code Optimization for 2G-BCCH
- Alarm based cell outage detection and resolution
- Further ANR Optimization
- Geo-enhanced versions of CCO for 3G and 4G
- First release (**Eden-NET 16EA**) with iSON Manager ported functionality, enabling:
  - Small Cell support
  - Automated Site Creation for WCDMA, LTE, small cells and SingleRAN
  - SON coordinator: Collision avoidance, Auto-verification and Rollback
  - PCI enhancements
  - Inter-RAT MRO

13 Confidential 11/13/15

eden rock communications NOKIA

Attachment 11 (Eden-Net with iSON Manager (2015)) at 13.

4.3.3 SON Module Manager

SON Module Managers are granted all the privileges of SON Module Executor and SON Monitor users. These privileges include:

- Stopping SON Modules

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

- Configuring, running, and scheduling future SON Module executions
- Viewing the content of SON Modules (when available)
- Retrieving and analyzing SON Module output performance reports
- Viewing and analyzing network performance metrics

Additional privileges granted to SON Module Managers are related to the management of available SON Modules and SON priorities. Specifically, these include:

- Setting both user and module priorities
- Managing advanced SON Module configuration
- Configuring SON Module default parameter values
- Configuring SON Exclusion List
- Configuring Black and White Lists
- Executing Network Rollback

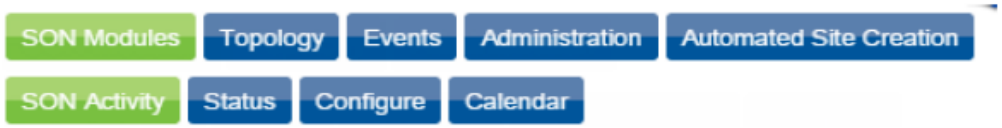
Attachment 12 (Eden-NET User Guide (2017)) at 10 and 11.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

5 Monitoring SON Modules

This section provides information on the Eden-NET home screen: SON Activity. The home screen is split up into sections showing information that relates to all SON Modules, individual module iterations, and visualizations of SON activity based on KPI performance data.



5.1 Monitoring SON activities

SON activities are monitored in the **SON Activity** screen under the **SON Modules** tab.

5.1.1 Viewing active SON Modules and SON module activity

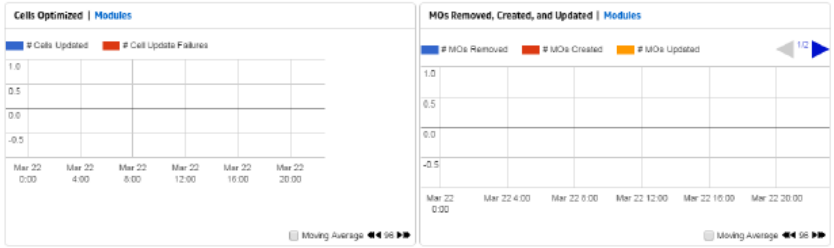
The Active SON Modules area of the SON Activity screen displays an overview of launch information for the initial instance of active modules.

Expected outcome

The **Active SON Modules** and **SON Module Activity** areas appear.

Note:

These parameter and Managed Objects (MO) changes are displayed visually on the SON Activity screen as well. Charts for this information are provided below the **SON Module Activity** area, with titles of Cells Optimized and MOs Removed, Created, and Updated.



Attachment 12 (Eden-NET User Guide (2017)) at 14.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
wherein the system of computers further analyzes the case files by analyzing the parameters of the communications to generate trends corresponding to the communications errors, and wherein the system of computers further compares the generated trends with a set of stored patterns that represent particular error types and resolutions.	Plaintiff contends the system of computers a portion of which is executing or loaded with Nokia Eden-Net solution analyzes the case files by analyzing the parameters of the communications to generate trends corresponding to the communications errors. Further, the system of computers compares the generated trends with a set of stored patterns that represent particular error types and resolutions. A wireless network comprises at least: (1) Radio Access Network comprising at least one base station controller, at least one transceiver, and at least one antenna; (2) a system of computers, the system of computers comprising computers associated with the at least one base station controller(s); computers functioning for network optimization, including at least computers implementing D-SON and C-SON; and, computers functioning for locating wireless devices; and, (3) one or more wireless devices.[3] The following exemplifies this limitation's existence in Accused Systems:

[3] A wireless device is considered within the wireless network when in RF communication. However, a processor of such wireless device may also be considered outside or inside the network.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Nokia Eden-NET®

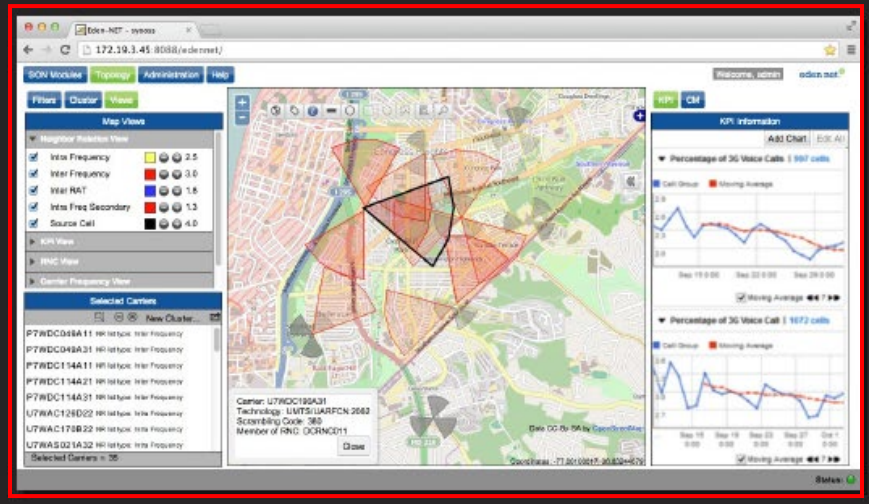
State of the art visualisation capabilities

Advanced MAP visualisation

- Visualisation of KPIs, based on KPI ranges
- Visualisation of cell status
- Visualisation of propagation delay.
- Polygon support.
- Advanced filtering options on map

KPI trend visualisation

- Visualisation of KPI in different forms (graphs, tables)



Attachment 11 (Eden-Net with iSON Manager (2015)) at 12.

5.1.3 Creating SON Module KPI chart

This screen displays the KPI chart for module level KPIs. These charts display the SON KPI information aggregated for all instances of the same module type, for example, a SON KPI chart for ANR MO additions shows MO additions for all module instances of ANR.

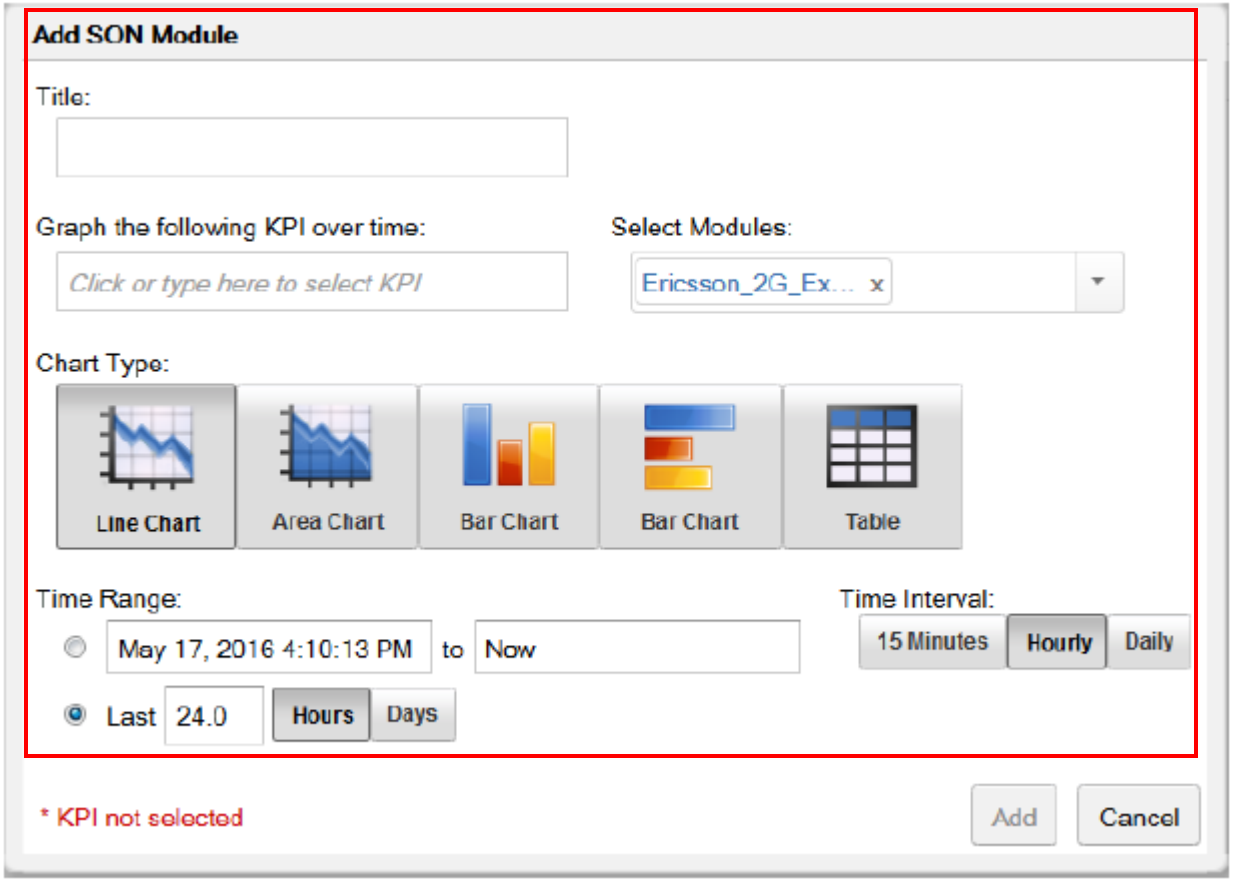
…

4. In **SON KPI Charts** tab, click the **Chart** icon.

The **Add SON Module** dialog box appears.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 12 (Eden-NET User Guide (2017)) at 16 and 17.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

5.1.4 Viewing user defined KPI charts

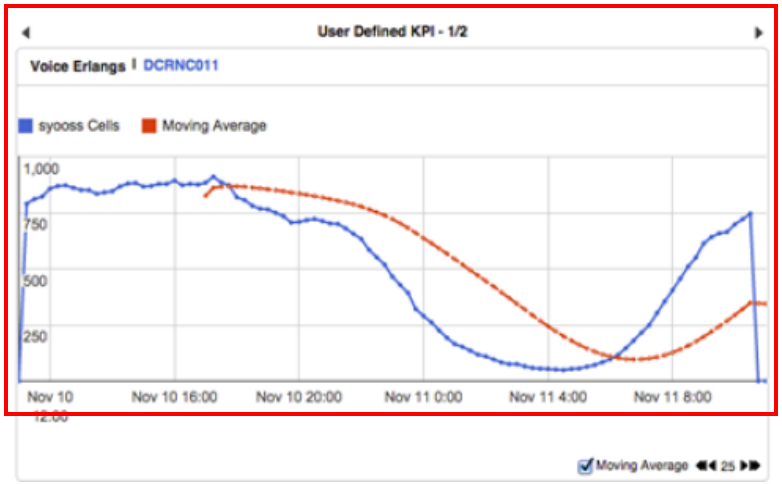
The User Defined KPI window of the **SON Activity** screen houses charts that graphically represent various Key Performance Indicators. To view charts:

1. *Log in to the Eden-NET application.*
2. Click the **SON Modules** tab.
3. Click the **SON Activity** tab.

Expected outcome

User Defined KPI charts are visible below the **SON Module Activity** area.

These charts are user-defined and are configured under the **Topology** tab. Once created, KPI charts can be sent to the home screen for easier accessibility of information.



Attachment 12 (Eden-NET User Guide (2017)) at 18.

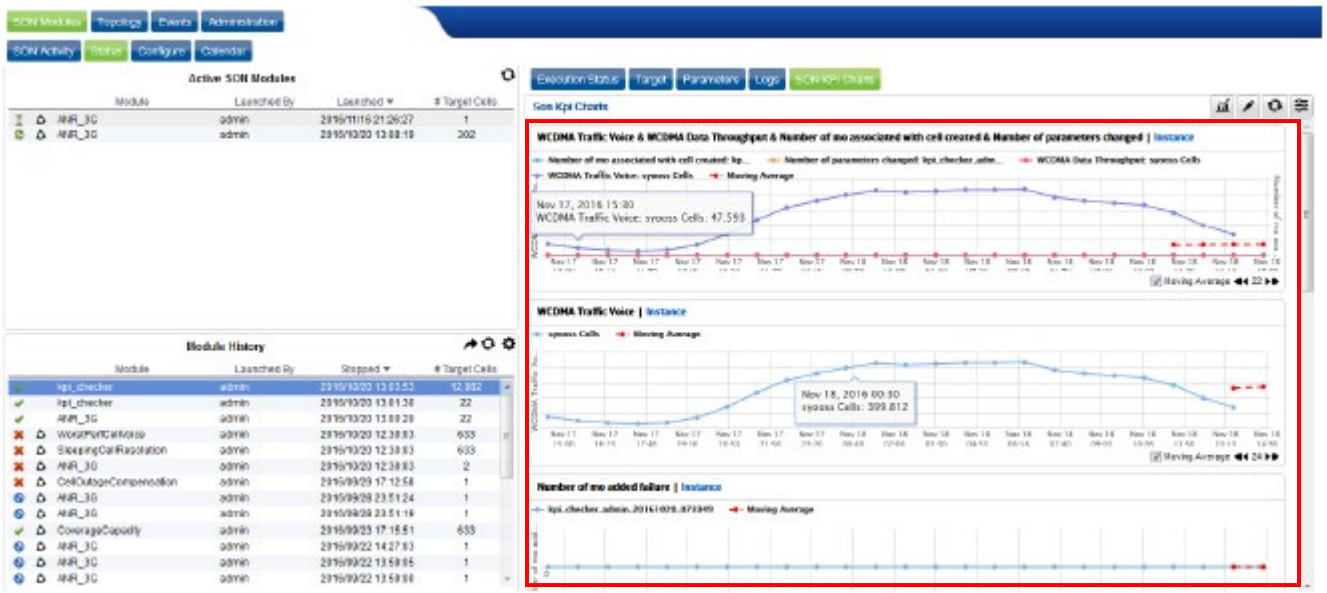
INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

5.2.9 Viewing SON KPI chart

This tab provides the user with the ability to graph different SON KPIs available for the specific module instance. User can create multiple graphs to be displayed simultaneously. As the user selects a different module instance from the list of active SON Modules or the Module History, Eden-NET refreshes the information of the SON KPI charts with the information from the selected module.

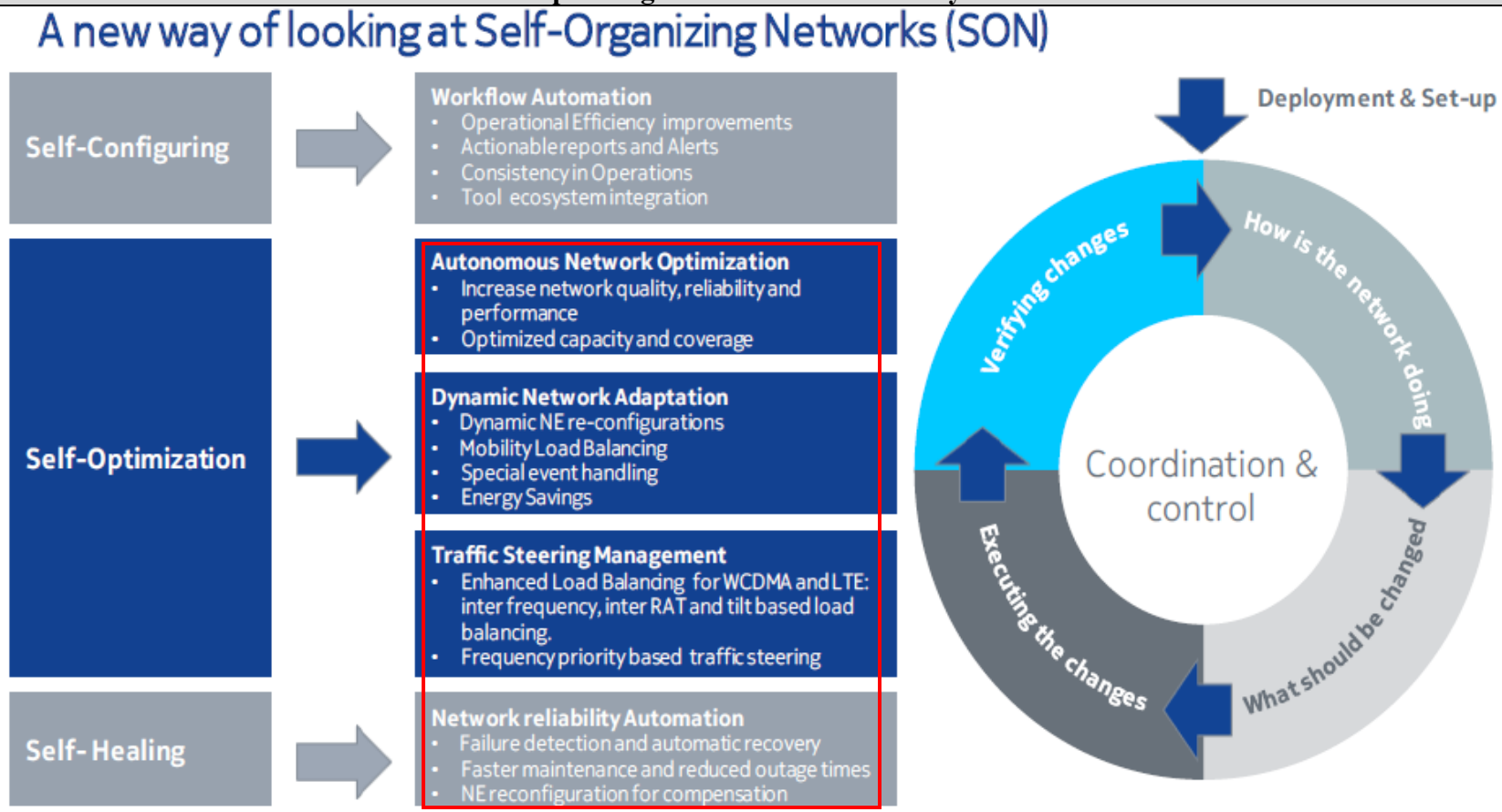
…



Attachment 12 (Eden-NET User Guide (2017)) at 24.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



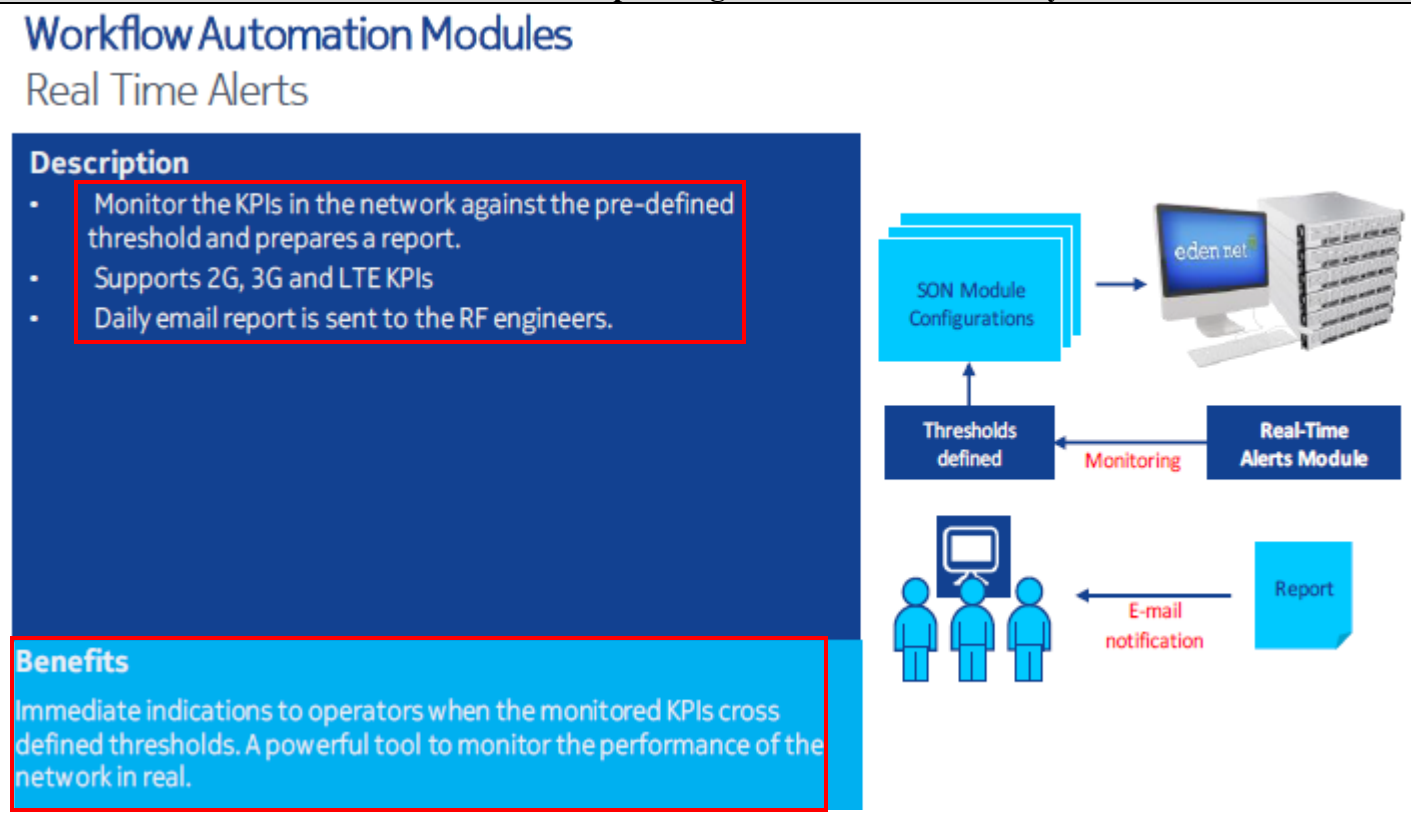
Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 6.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	Workflow Automation Modules Real Time Alerts **Overview:** • This module allows the users to evaluate specific KPIs for a set of target cells based on a set of predefined thresholds. • The module will monitor the KPIs in the network against the pre-defined threshold, prepare report and notify the user via email about worst performing area. … When a SON module is configured in Eden-NET, thresholds also need to be defined. The module that is in charge of watching the thresholds is called 'Real-Time Alerts'. The Real-Time Alerts module monitors all the KPIs in the GSM, WCDMA, and LTE networks against the thresholds definitions. When any KPI breaches its threshold, this module generates a report and notifies the user via email about the worst performing areas. **Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 51.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 52.

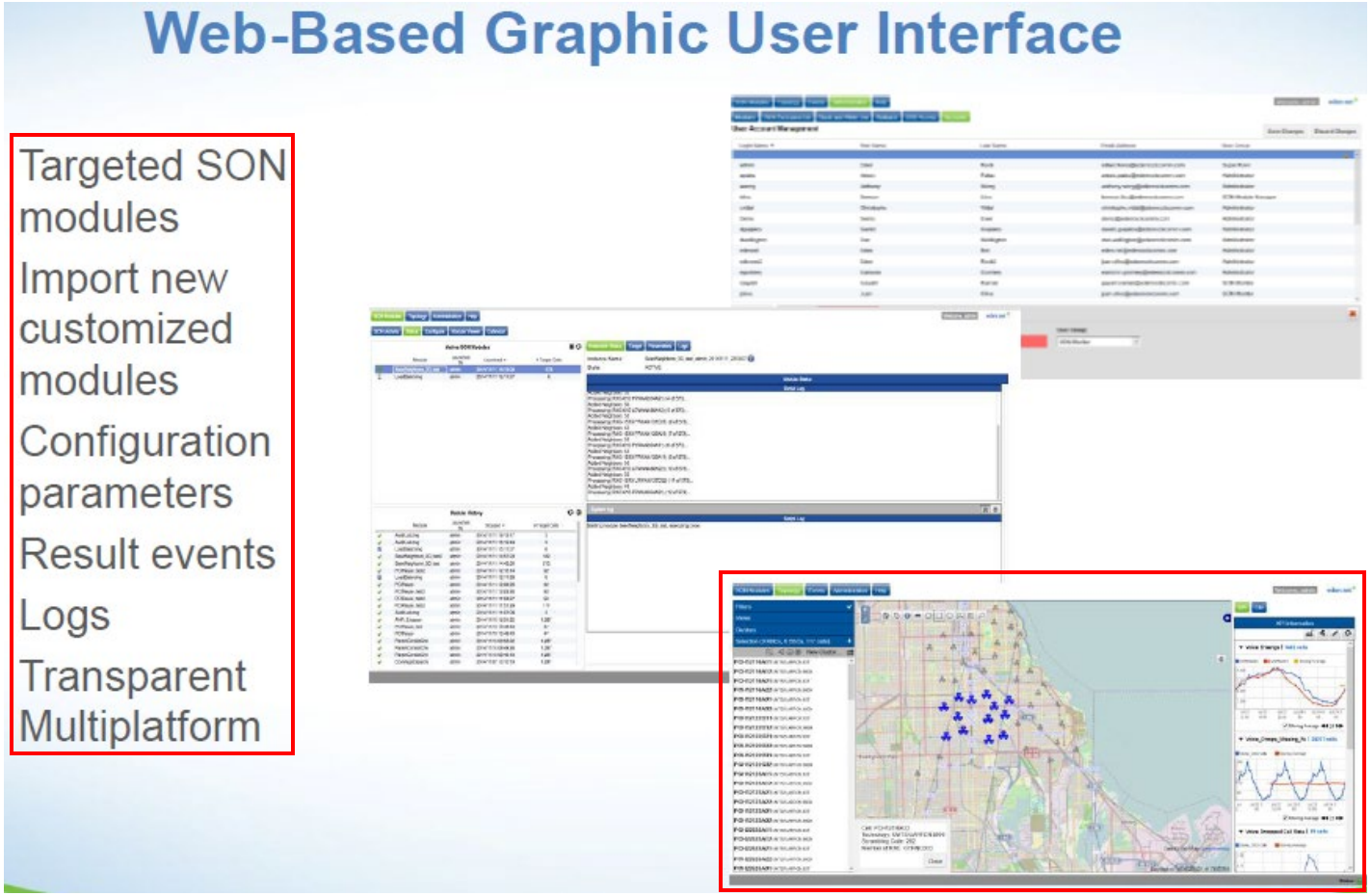
INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

NGMN Ref #	Use Case
Planning Related Use Cases	
[P01]	Base Station Location Planning
[P02]	Base Station Hardware Planning
[P03]	Automatic Generation of Radio Parameters
[P04]	Planning of transport parameters of a new Base Station
[P05]	Planning of security Node, Access GW and Operations and Maintenance Center
Deployment Use Cases	
[D01]	Hardware Installation
[D02]	Network authentication
[D03]	Software Installation
[D04]	Transport Parameter Setup
[D05]	Radio Parameter Setup
[D06]	Testing (Built in Diagnostic/Self Tests)
Optimization Use Cases	
[O01]	Radio Parameter Optimization: Neighbor cell list optimization
[O02]	Radio Parameter Optimization: Interference Control
[O03]	Radio Parameter Optimization: HO parameterization optimization
[O04]	Radio Parameter Optimization: QoS related parameter optimization
[O05]	Radio Parameter Optimization: Optimization Scenarios with Home BS/Pico BS
[O06]	Transport Parameter Optimization: Routing Optimization
[O07]	Transport Parameter Optimization: Optimization Scenarios with Home BS/Pico BS
[O08]	Reduction of Energy Consumption
[ERO01]	Capacity Optimization (Congestion Prime)
Maintenance Use Cases	
[Ops01]	Hardware / Capacity extension (Easy plug and play hardware replacement)
[Ops02]	Autonomous Inventory
[Ops03]	Automatic SW Download to Base Station
[Ops04]	Automated NEM upgrade
[Ops05]	Cell outage detection
[Ops06]	Performance Management in real time
[Ops07]	Direct KPI reporting in real time
[Ops08]	Information Correlation for Fault Management
[Ops09]	Subscriber and Equipment trace
[Ops10]	Cell Outage Compensation
[Ops11]	Compensation for Outage of higher level network elements (ASN GW)
[Ops12]	Fast recovery on instable NEM system
[Ops13]	Mitigation of outage of units
[EROps01]	System Availability

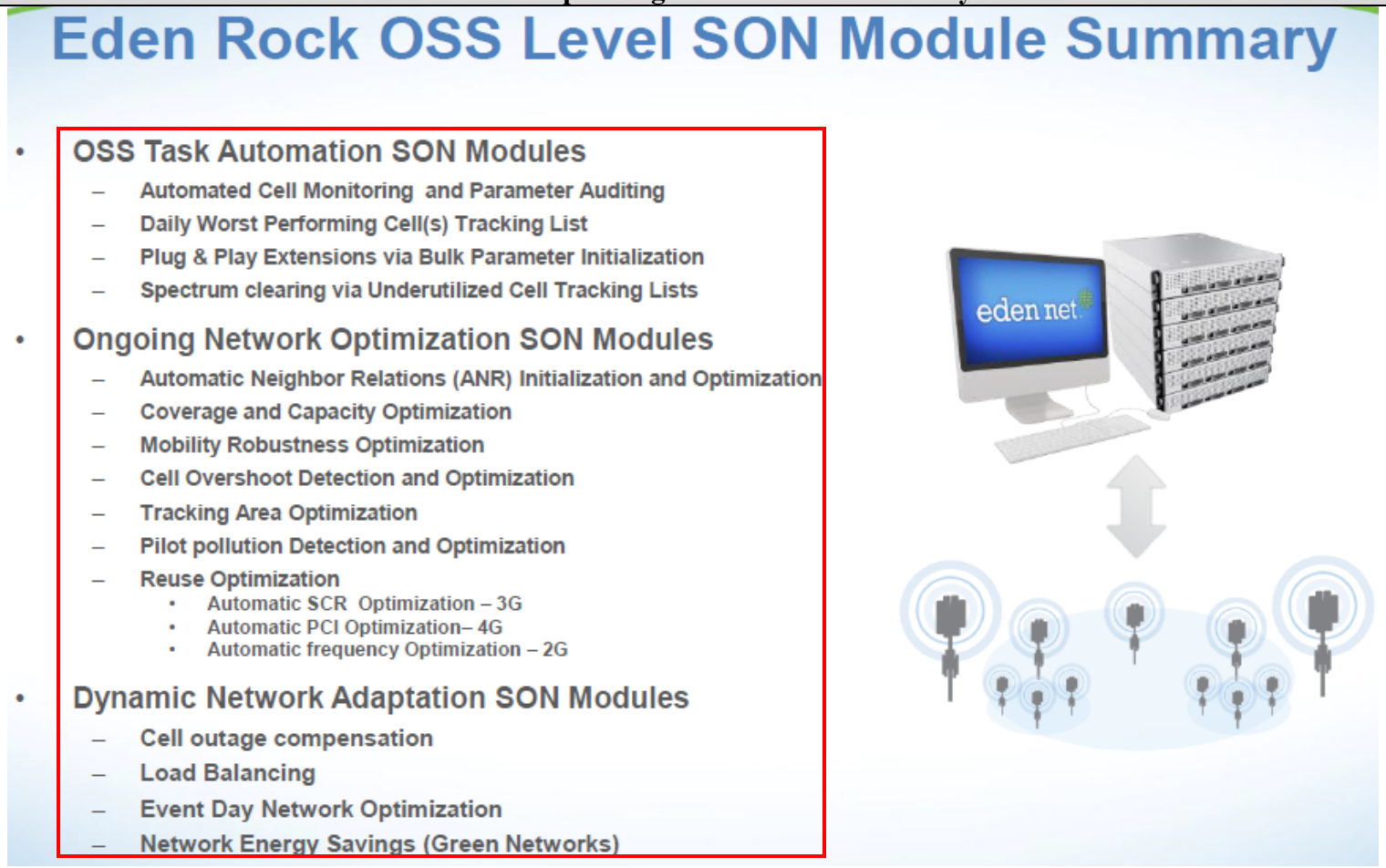
Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 10.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	 **Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 45.**

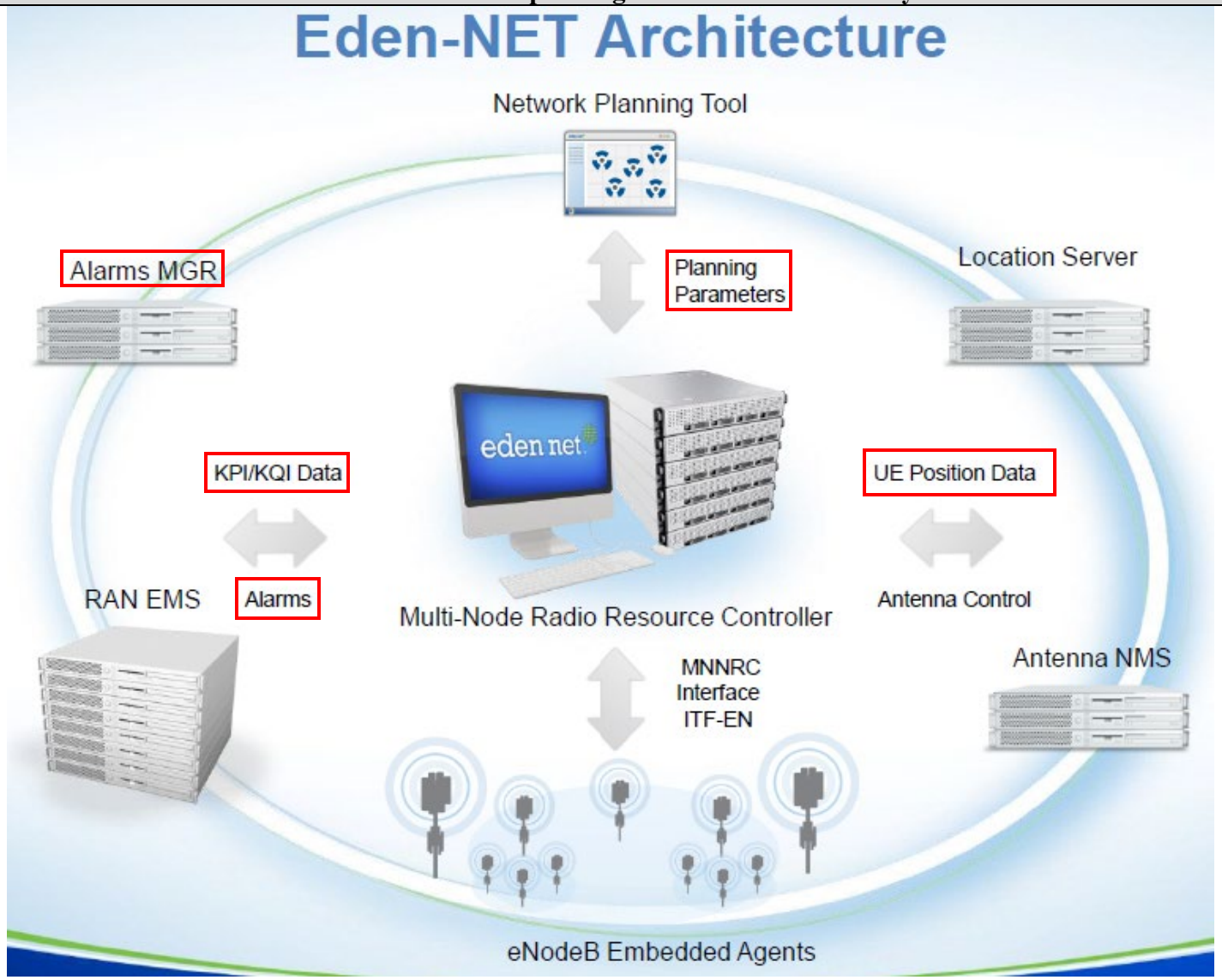
INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



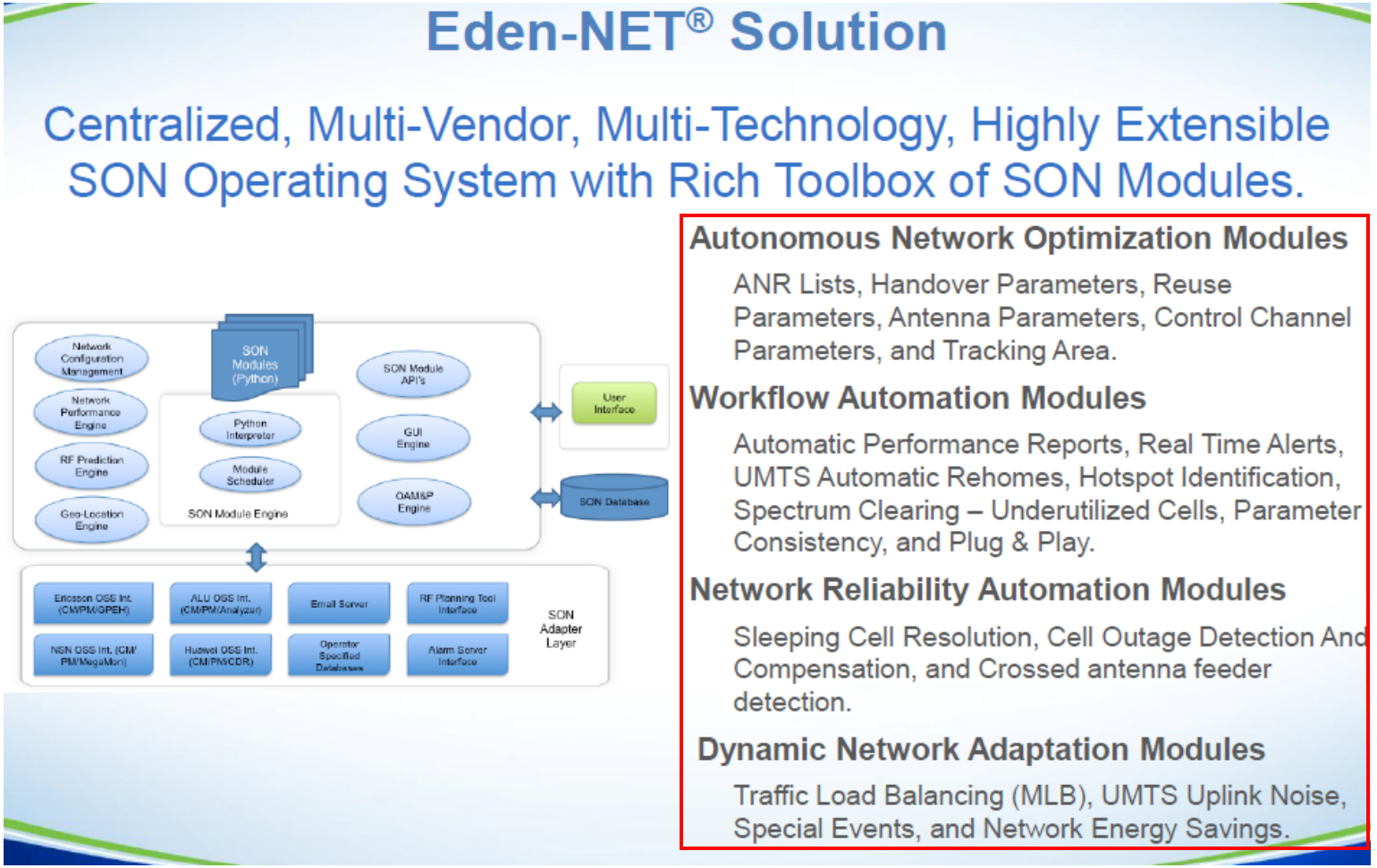
Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 35.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	 **Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 38.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

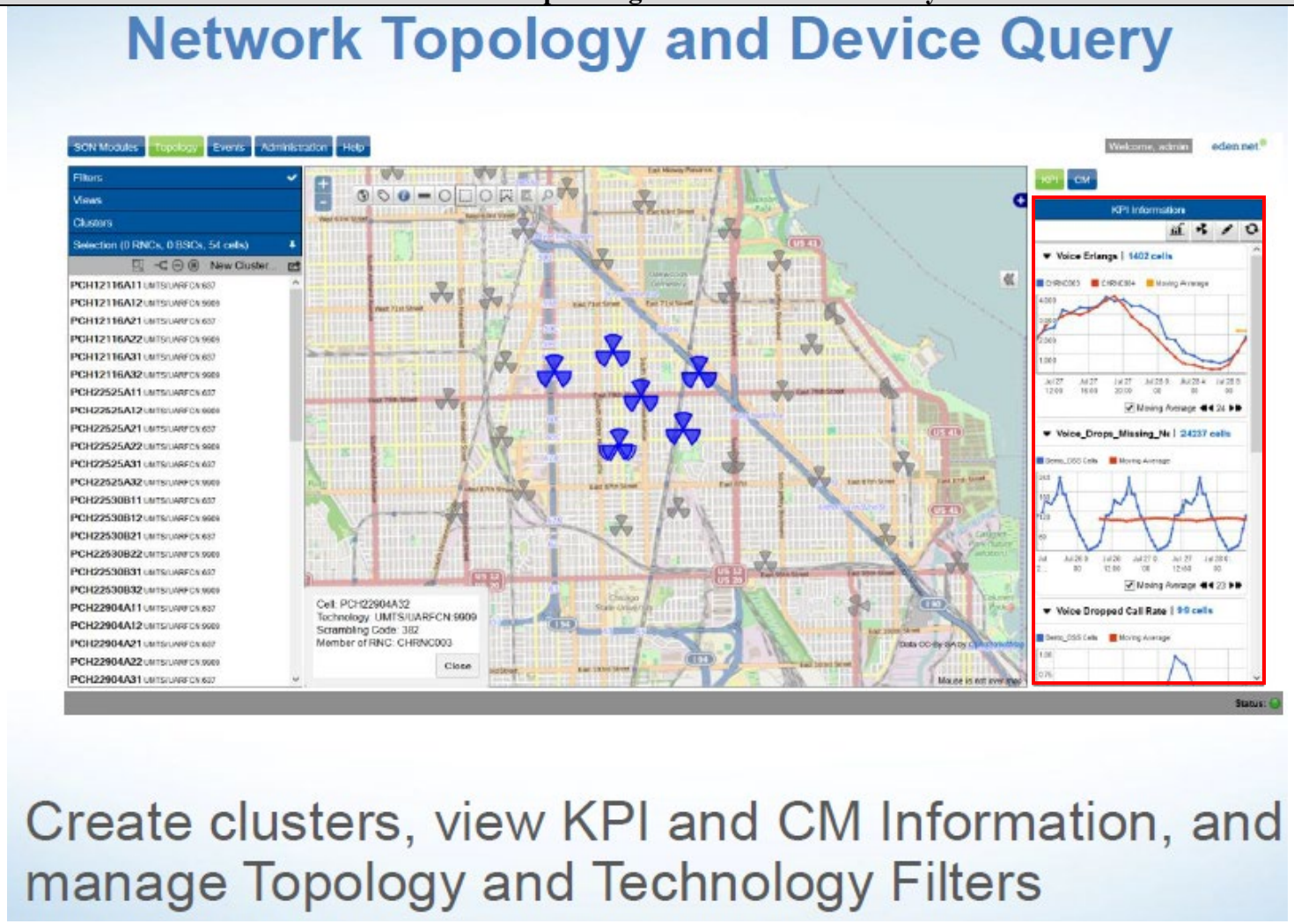
Claim 1	Corresponding Structure in Accused Systems



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 41.

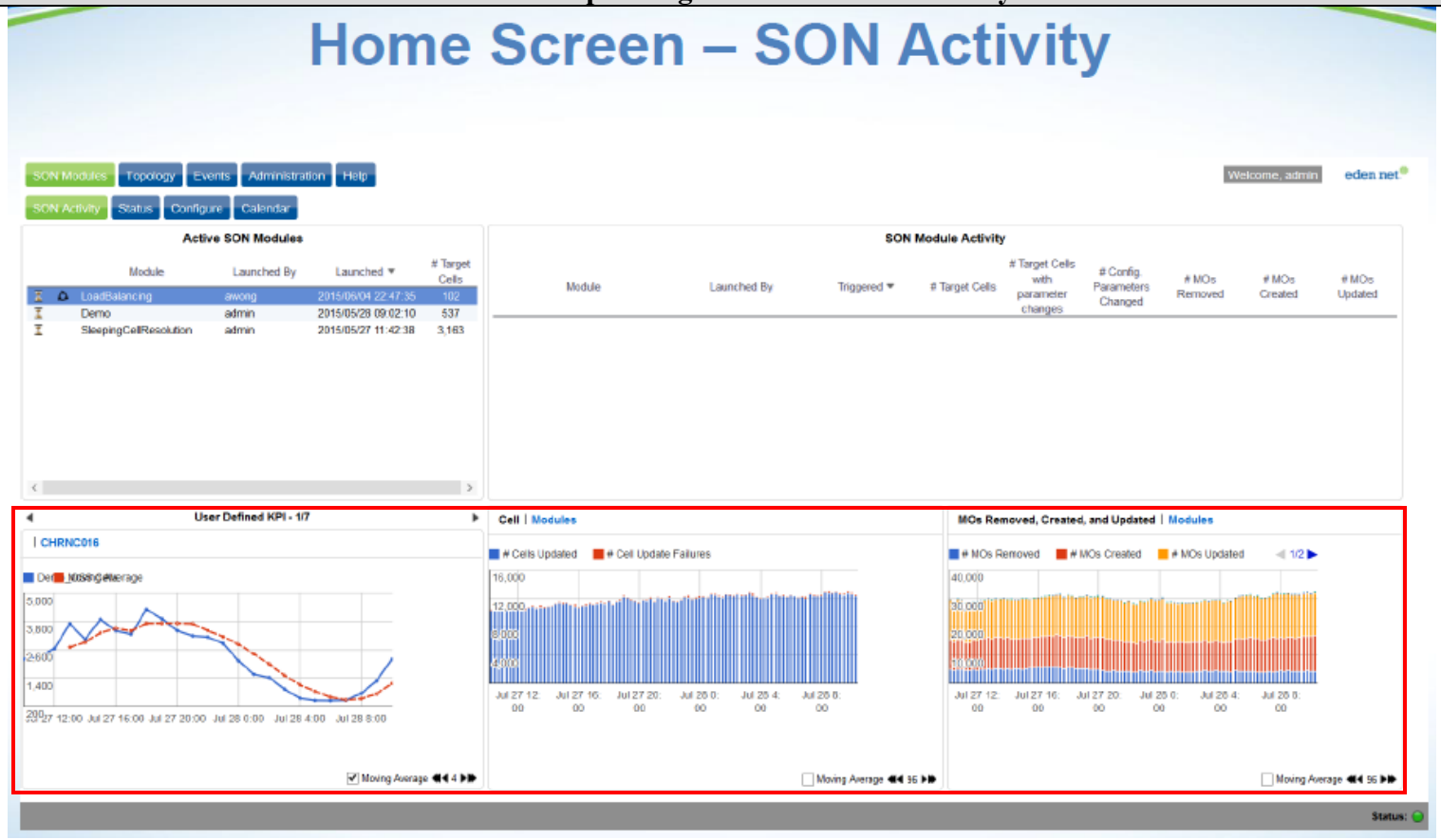
INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems



Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 49.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	

Attachment 9 (Eden NET Training Program - T Mobile US, Inc. (2014)) at 54.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Eden-NET® SON Modules

Deployed at Scale and Delivering the Industry's Best Results.

SON Module	2G	3G	4G
Automatic Performance Reports	↑	↑	↑
Real-Time Alerts	↑	↑	↑
Parameter Consistency Enforcement (PCE)	↑	↑	↑
Automatic Neighbor Relation (ANR)	↑	↑	↑
Layer Management Strategy (LMS)	↑	↑	↑
Reuse Code Optimization (RCO)	Q3	↑	↑
Coverage & Capacity Optimization (CCO)	N/A	↑	↑
Mobility Load Balancing (MLB)	N/A	↑	↑
Crossed Antenna Detection	↑	↑	↑
Plug & Play	N/A	↑	↑
Mobility Robustness Optimization (MRO)	N/A	Q1 '16	Q3
Sleeping Cell	N/A	↑	Q3
Automatic Parameter Optimization (APO)	Q4	Q4	Q4
Cell Outage Compensation	N/A	Q4	Q3
Special Event	Q4	Q4	Q4

SON Module	2G	3G	4G
Hotspot Identification	N/A	Q1 '16	Q1 '16
Enhanced Mobility Load Balancing (MLB)	N/A	Q1 '16	Q1 '16
Green Networks	Q1 '16	Q1 '16	Q1 '16
RACH Parameter Optimization	N/A	'16	Q4
Enhanced Plug & Play	N/A	N/A	Q1 '16
Spectrum Clearing	'16	N/A	N/A
Carrier Aggregation Optimization	N/A	N/A	'16
VoLTE Optimization	N/A	N/A	'16
Data Correlation	N/A	'16	'16
Tracking Area Optimization	N/A	N/A	'16
eICIC Optimization	N/A	N/A	'16
MIMO Optimization	N/A	N/A	'16
Uplink Noise Optimization	N/A	'16	N/A
CoMP Reporting	N/A	N/A	'16

NOKIA

Attachment 11 (Eden-Net with iSON Manager (2015)) at 7.

5.3 LTE1049: MDT - UE Measurement Logs

5.3.1 Description of LTE1049: MDT - UE Measurement Logs

Introduction to the feature

The *LTE1049: MDT - UE Measurement Logs* feature allows the eNodeB to support the configuration and retrieval of user equipment (UE) measurement logs as well as to report those with a cell trace.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

…

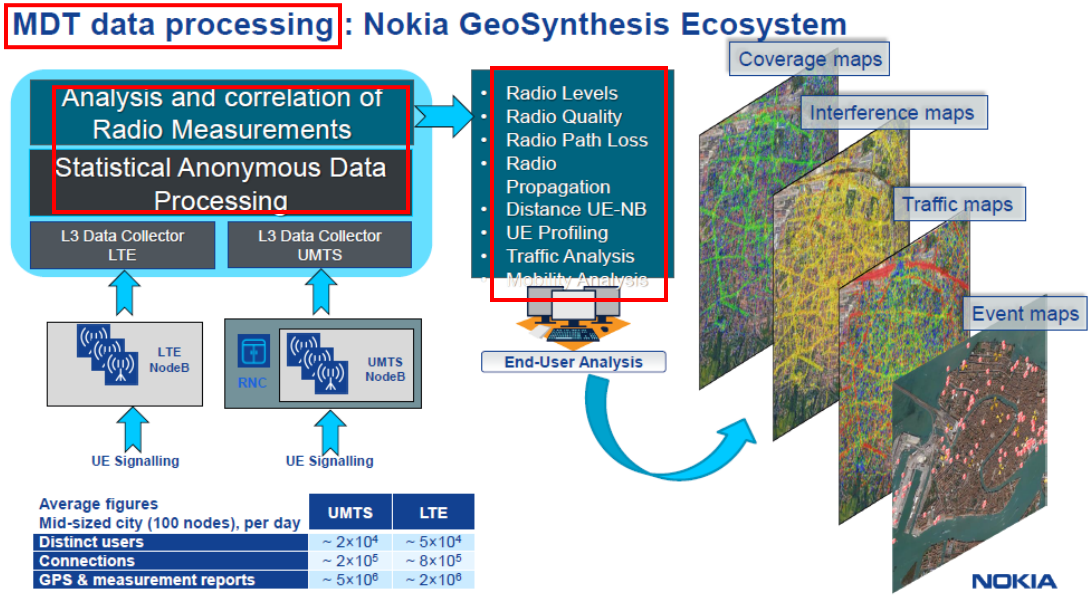
operators. A minimization of drive tests (MDT) has been proposed in order to meet operator requirements. It is a method of collecting the DT data directly from regular UEs used in the network; it is a less expensive approach to DTs. There are two modes of MDT measurements:

…

The UE measurement logs contain the following information:

- location info (global navigation satellite system (GNSS) information is optional for the UE)
- time stamp
- serving cell ID
- serving cell measurements
- neighbor cell measurements

Attachment 14 (FDD-LTE15A, Feature Descriptions and Instructions (2015)) at 308 and 309.



INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	Attachment 13 (Minimization of Drive Test (MDT) An Innovative Methodology for Measuring Customer Performance on Mobile Network (2016)) at 7.

Capacity and Coverage Optimization (CCO)

Nokia Eden-NET

Network challenge

- Optimal network settings are not possible to be reached only by planning
- Manual optimization requires huge effort in constantly changing multilayer network
- Bad behaving cells, such as overshooters, are hard to find manually and they have impacts on wider area
- Balancing between capacity and coverage

Value driver

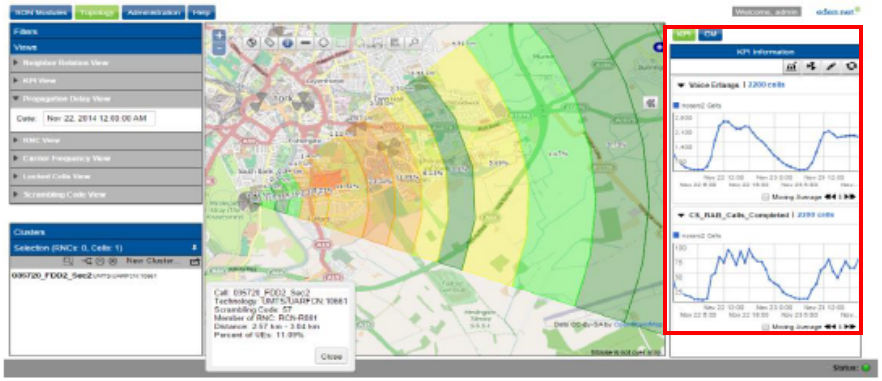
- Identification of over-shooting and under-shooting cells to achieve performance gains

KPI Improvements

- 30% Call drop rates (improved voice quality and accessibility)
- 13% Handover success rate
- Average throughput (capacity and spectral efficiency)

Solution

- CCO scans multiple radio access technologies and multiple radio access network vendors to detect coverage gaps, interference and overshooters
- CCO optimizes the coverage via advanced antenna and cell power adjustments



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NOKIA

Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 19.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Mobility Load Balancing (MLB)

Nokia Eden-NET

Network challenge

- Part of the cells may be occasionally overloaded, causing access failures and dropped calls
- Ensuring network quality would require building extra capacity

Value driver

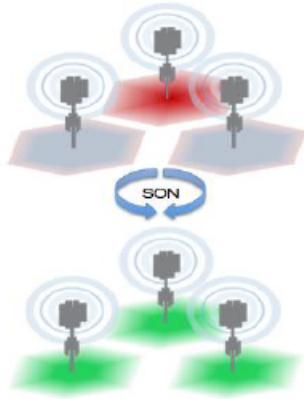
- 90% reduced manual operational efforts during cell congestion
- Maintaining network quality in case of peak load without need of extra capacity -> CAPEX savings

Solution

- MLB optimization triggers a redistribution of traffic from the overloaded cells to lightly loaded neighbor cells
- Results in
  - Evenly loaded network
  - Reduced voice and data dropped calls
  - Improved voice and data accessibility

KPI Improvements

- 12% Speech drop rate
- 16% Speech Setup success rate
- Traffic Volumes
- Channel utilization
- Traffic Latency
- Average per-user throughput



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 20.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Automatic Parameter Optimization

Nokia Eden-NET

Network challenge

- How to find optimal combination of parameters to reach desired KPI values

Solution

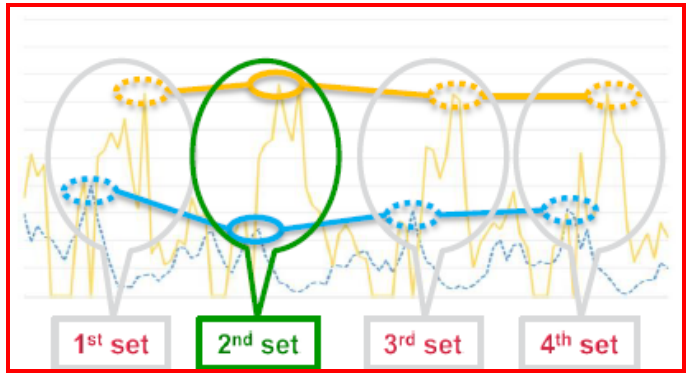
- Automatic Parameter Optimization finds optimal configurations by evaluating different parameter sets against performance metrics for multi vendor 2G, 3G and 4G networks.
- Supports rollback to the initial values, if needed
- Supports permanent pushing of optimal configuration into the
- WCDMA uplink noise optimization included

Value driver

- 90% OPEX reduction in customized configuration for new radio network features
- Faster rollout of new radio network features with optimal configuration

KPI Improvements

- Decreased call drop rate
- Handover success rate
- Average throughput



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 26.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Cell Outage Compensation

Nokia Eden-NET

Network challenge

- How to maintain coverage and capacity in case of a cell outage (when not recovered by Cell Outage Resolution)

Solution

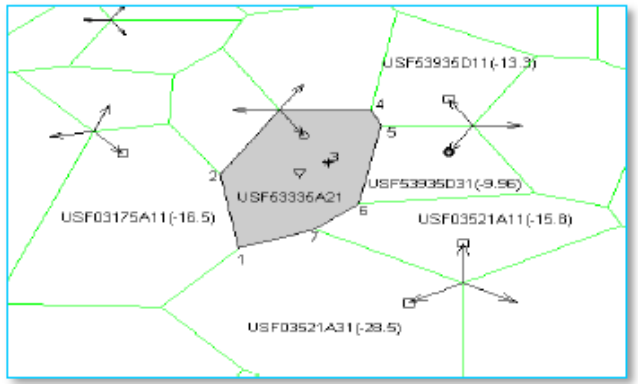
- Examines the neighboring replacement cell(s)
  - KPIs to determine if a coverage gap has been caused as a result of the cell outage
  - which target cells' parameters can be adjusted without congestion when picking up the traffic
- Compensates by adjusting the electrical antenna tilt or transmission power to extend the coverage area
- Monitors the replacement cells to detect congestion and reverts the operation if needed

Value driver

- 90% reduction of manual efforts in detecting and compensating coverage gaps
- Ensure coverage

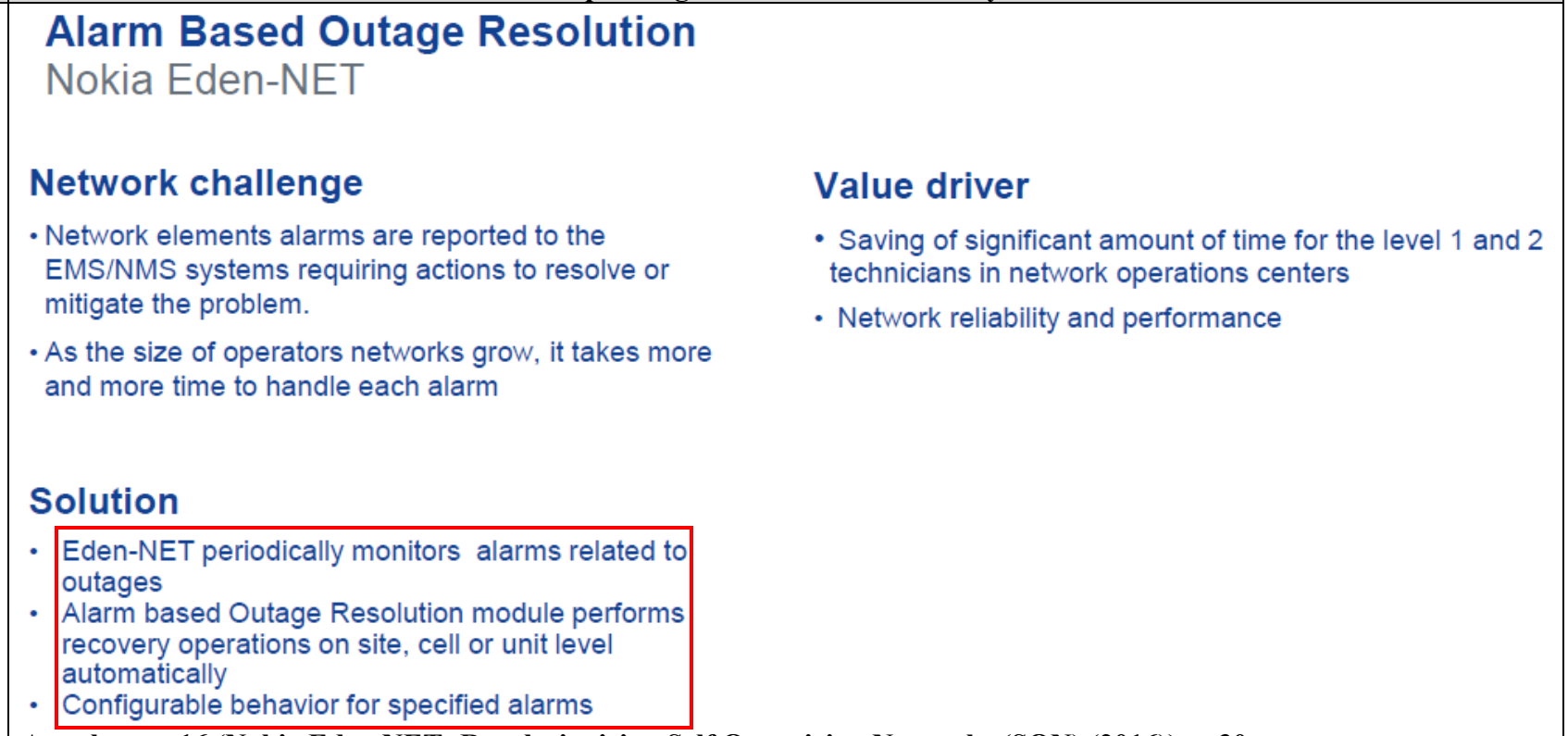
KPI Improvements

- Decreased call drop rate
- Handover success rate
- Average throughput



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 29.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	 **Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 30.**

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

RACH Parameter Optimization

Nokia Eden-NET

Network challenge

- How to allocate initial RACH (Random Access Channel) parameters
- Find conflicts or inconsistencies in the 4G network faster in changing radio conditions

Value driver

- 90% reduction in manual operational efforts in identifying and resolving conflicts in RACH
- Faster rollout of new radio network features with optimal configuration

KPI Improvements

- Handover success rate

Solution

- Ensures that the PRACH configurations of an LTE cell are unique within its neighborhood.
- Optimizes PRACH Allocations
- Supports time, frequency and code separation (3GPP compliant).
- Works together with D-SON capacity and power optimizations.

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Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 35.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Mobility Robustness Optimization (MRO)

Nokia Eden-NET

Network challenge

- Different types of handover failures affect on user experience
- Inefficient use of network resources due to unnecessary or missed handovers
- Tracking and optimizing the performance of each neighbor relation in heterogeneous network deployments

Solution

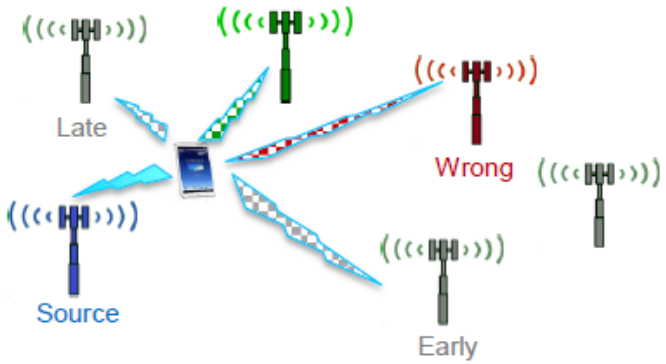
- MRO optimizes HO parameters to improve the mobility quality i.e. handover success rate between LTE cells
  - Late handovers
  - Early handovers
  - Handovers to a wrong cell (sub-optimal)
  - Ping pong handovers

Value drivers

- Reduced operational efforts
- Reduction of dropped calls to maximize call minutes

KPI Improvements

- 30% Handover ping pong
- 10% Handover to wrong cell
- 6% Intra frequency HO success rate
- 3% early handovers



Attachment 16 (Nokia Eden NET: Revolutionizing Self Organizing Networks (SON) (2016)) at 24.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

Autonomous Network Optimization Modules

Coverage and Capacity Optimization (CCO)

Overview:

- The Eden-NET LTE CCO module detects LTE cells that are overshooting and undershooting and apply corrective actions to mitigate this issue through either antenna tilts.
- By controlling the coverage footprint the module shall reduce interference and improve cell capacity.
- The CCO module identifies overshooting and the undershooting cells in the network.
- The CCO module will recommend down-tilting the over-shooters and up-tilting the under-shooters. These recommendations are implemented in an open-loop. In order for these recommendations to be actually implemented, the antennas to be up-tilted or down-tilted need to support RET.
- **Module :** CoverageCapacity / LTECCO
- **Supported vendors and technologies:** Nokia, Ericsson, Huawei, ALU (WCDMA, LTE), ZTE (WCDMA – limited support)

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3G CCO:
The 3G CCO Module identifies which cells are under-shooters and over-shooters by analyzing the neighbor-directed handover attempts and successes, Detected Set Reporting (DSR), Call Trace Events, antenna location and azimuth information, and tilt score.
Then, this module proposes corrective actions for the most severely undershooting and overshooting cells. The corrective actions will be in-line with the configurable CCO policies, such as: max tilt adjustment, or power adjustment per iteration.
The up-tilt or down-tilt actions of the antenna beam will be either done as open-loop or closed-loop modes.
Finally, this module generates a report with all the changes performed during the closed-loop implementation. Closed-loop means that the configuration changes are actually implemented to the antenna with the help of RET after execution.

4G CCO: The 4G CCO module uses several handover, antenna, location, neighbor information data, and KPIs to detect under-shooting and over-shooting cells.
The CCO module will recommend down-tilting the over-shooters and up-tilting the under-shooters. These recommendations are to be implemented in open-loop or closed-loop. Open-loop means that the configurations will not be actually applied but just checked for consistency. The closed-loop implementation is actually performed on antennas that support RET.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems
	Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 29. Autonomous Network Optimization Modules Mobility Robustness Optimization (MRO) **Overview:** • The Mobility Robustness Optimization (or MRO) module automatically detects and corrects LTE mobility errors that cause Radio Link Failure (RLF) due to: early handover, late handover, or handover to the wrong cell. • This module corrects the LTE mobility errors by optimizing the mobility parameters between LTE cells on the same frequency, or by rollback to previous configurations if degradation was observed after a configuration change. It also optimizes the connected mode parameters and checks if this creates an unbalance with the idle mode. **Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 31.** Autonomous Network Optimization Modules PRACH Parameter Optimization **Overview:** • PRACH allocations in one cell might interfere with PRACH allocations in other neighboring cells, thereby decreasing the RACH detection probability and limited coverage. • PRACH configuration of a LTE cell should be unique in its neighborhood • Manual planning of PRACH parameters is tedious and error prone • This module provides quick fine tuning of PRACH parameters to suit changing radio conditions • Resulting in improved Random access performance …

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

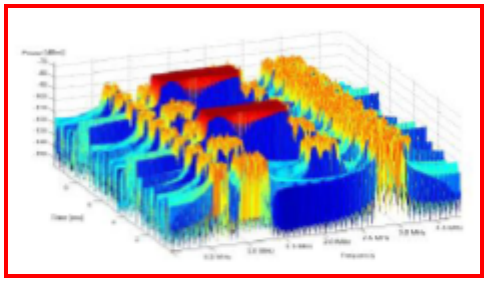
Autonomous Network Optimization Modules

PRACH Parameter Optimization

Description

PRACH optimization feature in Eden-NET allow operators to perform the following operations:

- Fresh Allocation:
  - Existing PRACH allocation is erased and a fresh allocation is done for all LNCELs in scope
- Detect and Resolve PRACH Conflicts:
  - All the LNCELs in scope are checked & resolved their conflicts.
- Detect and Resolve PRACH Inconsistencies:
  - All the LNCELs in scope are checked & resolved their inconsistencies



Benefits

Minimize UL interference among RACH attempts from neighboring cells

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 33.

Autonomous Network Optimization Modules

Automatic Parameter Optimization

Overview:

- Operators are trying to get the most out of their networks everyday. This requires that each and every parameter is set to an optimal value depending on the various operator scenarios.
- Optimizing radio parameters is a laborious time consuming manual process.

INFRINGEMENT CONTENTIONS
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Claim 1	Corresponding Structure in Accused Systems

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The Automatic Parameter Optimization module automates the tuning of a set of parameters to reach a defined goal. Trials of these tunings are carried out with different combinations in each iteration. If parameters have not been optimized, this module will return to the initial values.

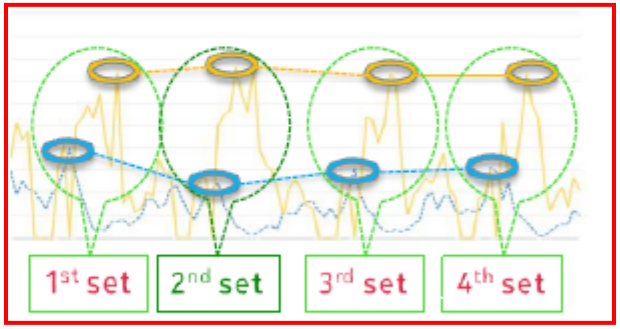
Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 37.

Autonomous Network Optimization Modules

Automatic Parameter Optimization

Description

- Automatic Parameter Optimization module allows customer to arrive at optimal configurations by evaluating different parameter sets against performance metrics in an automated manner for multi vendor networks.
- Supports rollback to the initial values
- Supports permanent pushing of optimal configuration into the network.
- Facilitate customized configuration for new radio network features.



Benefits

Faster rollout of new radio network features with optimal configuration

OPEX reduction in customized configuration for new radio network features.

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 38.

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U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems

The Mobility Load Balancing (MLB) module is a function that automatically allows cells suffering from congestion to steer a percentage of their traffic to other, less loaded neighboring cells. This distributed load on available cells results in higher network throughput and efficient network utilization.

The MLB module collects several congestion indicators for each target cell at every iteration related to traffic volumes, network resources utilization, and average throughput. Then, it examines these KPIs to determine if there are any overloaded cells. Any detected traffic overload will be distributed to less-loaded neighbor cells. Finally, the MLB module monitors several mobility KPIs of optimized cells to ensure that correct decisions have been made.

Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 43.

Dynamic Network Adaptation Modules

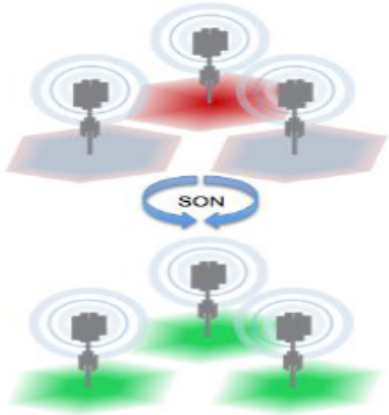
Mobility Load Balancing (MLB)

Description

- Module identifies cells that are overloaded based on data access failures, call drop rates, average Received Total Wideband Power(RTWP) and other relevant KPIs.
- The optimization triggers a redistribution of traffic from the overloaded cells to lightly loaded neighbor cells.
- The MLB algorithm ensures that the redistribution does not create a new overloaded cell or distribute traffic to already overloaded neighbor cells.
- All changes are reverted to original settings when the congestion timer expires.

Benefits

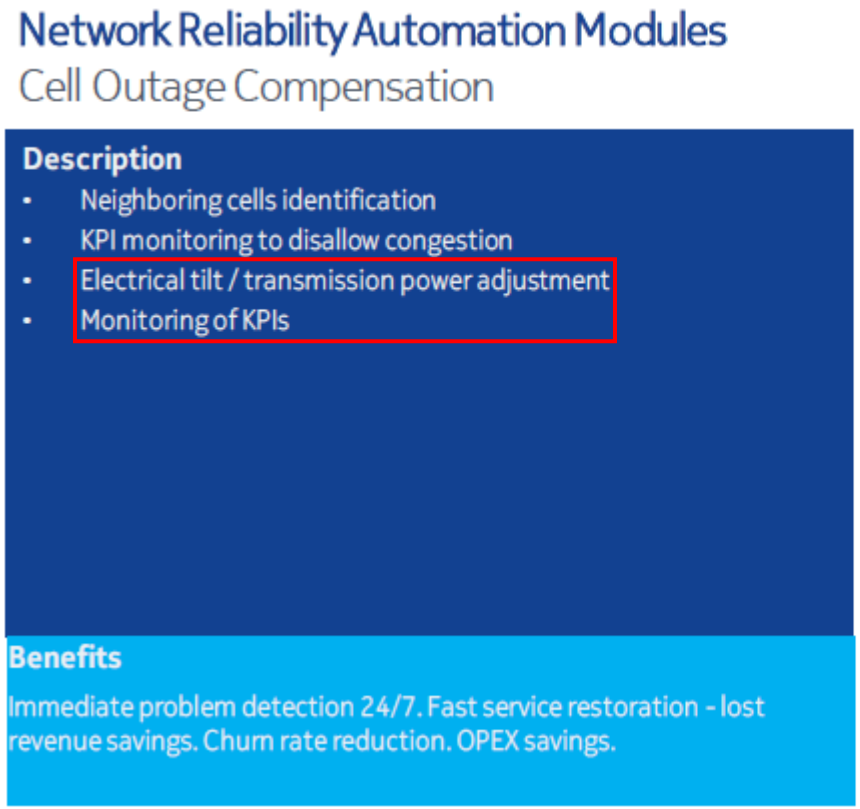
Operations and network efficiency: OPEX saving can be achieved by automated analysis and optimization process. CAPEX saving by efficiently utilizing existing network resources during increased traffic demands.

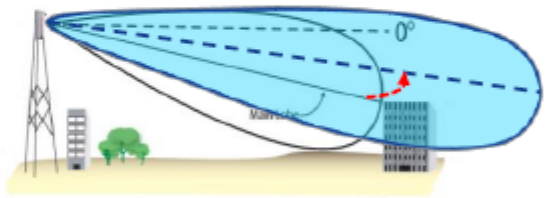


Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 45.

INFRINGEMENT CONTENTIONS
U.S. PATENT NO. 10,448,209 – CLAIM 1

Claim 1	Corresponding Structure in Accused Systems





Attachment 10 (NokiaEDU Eden-NET Overview Course (2017)) at 61.